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VIRGINIA ACADEMY OF SCIENCE

PROCEEDINGS FOR THE YEAR
1953 - 1954

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THE VIRGINIA JOURNAL OF SCIENCE

VOL. 5, NEW SERIES No. 4

VIRGINIA ACADEMY OF SCIENCE

Proceedings for the Year 1953--1954

MINUTES OF THE THIRTY-SECOND ANNUAL MEETING

MAY 5, 6, 7, 8, 1954

AT THE UNIVERSITY OF VIRGINIA

CHARLOTTESVILLE, VIRGINIA

LIST OF PRESIDENTS

IVEY F. LEWIS	1923-24
JAMES LEWIS HOWE	1924-25
ROBERT E. LOVING	1925-26
*J. SHELTON HORSLEY	1926-27
*DONALD W. DAVIS	1927-28
WM. MOSELEY BROWN	1928-29
GARNETT RYLAND	1929-30
L. G. HOXTON	1930-31
I. D. WILSON	1931-32
T. MCN. SIMPSON, JR.	1932-33
WILLIAM A. KEPNER	1933-34
WILLIAM T. SANGER	1934-35
IDA SITLER	1935-36
H. E. JORDAN	1936-37
D. MAURICE ALLAN	1937-38
EARLE B. NORRIS	1938-39
RUSKIN S. FREER	1939-40
*WORTLEY F. RUDD	1940-41
GEORGE W. JEFFERS	1941-42
MARCELLUS H. STOW	1942-43
*W. CATESBY JONES	1943-44
ROBERT F. SMART	1944-45
H. RUPERT HANMER	1945-46
ARTHUR BEVAN	1946-47
JESSE W. BEAMS	1947-48
SIDNEY S. NEGUS	1948-49
BOYD HARSHBARGER	1949-50
GUY W. HORSLEY	1950-51
PAUL M. PATTERSON	1951-52
LLOYD C. BIRD	1952-53
ALLAN T. GWATHMEY	1953-54
IRVING G. FOSTER	1954-55
WALTER S. FLORY, JR.	1955-56

* Deceased.

Virginia Academy of Science

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COLGATE W. DARDEN, JR., *President*

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Box 1420, Richmond 11

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Marcellus Stow

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Lloyd C. Bird (1956)
Allan T. Gwathmey (1957)

PRESIDENT'S ADVISORY COMMITTEE
(*Elected by Sections*)

Officers of Sections for 1954-1955

Agricultural Sciences: Rodney C. Berry, Chairman; R. W. Engel, Vice-Chairman; Paul M. Reaves, Secretary; Wesley P. Judkins, Section Editor (1956)

Astronomy, Mathematics, and Physics: H. Y. Loh, Chairman; T. E. Lothery, Secretary; F. L. Hereford, Section Editor (1956).

Bacteriology: H. J. Welshimer, Chairman; W. F. Lawrence, Vice-Chairman; M. C. Bowles, Secretary-Treasurer; J. Douglas Reid, Section Editor (1956).

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Statistics: W. S. Connor, Chairman; M. C. K. Tweedie, Vice-Chairman; Clyde Y. Kramer, Secretary; Lionel Weiss, Section Editor (1959).

COMMITTEES APPOINTED BY PRESIDENT FOSTER

Officers of the Academy will be ex-officio members of all committees

LONG RANGE PLANNING

E. S. Harlow, *Chairman*
Box 4178, Richmond

Lloyd C. Bird	L. D. Abbott	Henry Leidheiser
R. W. Engel	J. W. Cole	Sidney S. Negus
George W. Jeffers	W. G. Guy	Lorin A. Thompson
Allen Gwathmey	W. T. Ham, Jr.	W. B. Wartman, Jr.
Marcellus Stow	Ladley Husted	

RESEARCH

Chalmers L. Gemmill, *Chairman* (1955)
Dept. of Pharmacology, Univ. of Va., Charlottesville

Frank J. Hereford (1955)	John Forbes (1957)
D. Maurice Allen (1956)	Robert T. Brumfield (1958)
R. C. Krug (1956)	David B. Duncan (1959)

FINANCE AND ENDOWMENT

Lloyd C. Bird, *Chairman*
Box 2-V, Richmond

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Boyd Harshbarger	Sidney S. Negus	Robert F. Smart
	Charles T. O'Neill	

VIRGINIA FLORA

A. B. Massey, *Chairman*
Virginia Polytechnic Institute, Blacksburg

Lena Artz	Ruskin S. Freer	Paul W. Patterson
R. P. Carroll	Walter S. Flory	

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Susie V. Floyd	Franklin D. Kizer	George Sands
Walter S. Flory	Reuben R. McDaniel	Felix Sanders
E. Sherman Grable	Richard Morgan	

RESOLUTIONS

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Box 498, Blacksburg, Va.

J. I. Baldwin, Jr. Martha W. Duke

NOMINATIONS

Paul M. Patterson, *Chairman*
Hollins College, Hollins, Va.

Lloyd C. Bird Allen T. Gwathmey

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R. A. Bradley	P. Arne Hansen	William E. Trout, Jr.
Caroline Gambrill	Richard H. Henneman	L. W. Webb, Jr.

PLACE OF MEETING

Stanley B. Williams, *Chairman*
College of William and Mary, Williamsburg

Sidney Negus L. W. Webb, Jr.

RESOURCE-USE EDUCATION

J. J. Shoman, *Chairman*
826 E. 45th St., Richmond

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A. H. Anderson	Harry S. Mosby	R. J. Walker
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William C. Cooper	W. W. Nobb	Alfred L. Wingo
T. V. Downing	Mrs. H. Gray Parker	Percy H. Warren
Harry S. Jopson	Elizabeth Perry	I. D. Wilson

JAMES RIVER PROJECT

Marcellus Stow, *Chairman*

Washington and Lee University, Lexington

Robert P. Carroll
Justus H. Cline
Ivey F. Lewis
A. B. Massey
Charles T. O'Neil
Foley F. Smith
I. D. Wilson

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JEFFERSON MEDAL WINNERS

RECIPIENTS OF THE JEFFERSON GOLD MEDAL [1]

Alfred Chanutin	1936
William B. Porter	1937
H. M. Phillips	1938
C. M. Shear and H. D. Ussery	1939

RECIPIENTS OF THE JEFFERSON PRIZE [2]

L. G. Overholzer and John H. Yoe	1940
Allan T. Gwathmey	1941
R. N. Jefferson	1942
W. H. Hough	1943
Clinton B. Cosby	1944

RECIPIENTS OF J. SHELTON HORSLEY RESEARCH AWARDS

Carl C. Speidel	1927
John H. Yoe	1928
J. C. Street	1929
H. E. Jordan	
Carl C. Speidel	1930
E. C. Stevenson	1931
James H. Smith	1932
S. A. Wingard	1933
E. P. Johnson	1934
Margaret Hess	1935
Alfred Chanutin	1936
R. G. Henderson	1937
S. G. Bedell	1938
M. J. Murray	
F. F. Cleveland	1939
Walton C. Gregory	1940
Charles Ray	1941
No Award	1942
J. B. Meyer	1943
J. H. Taylor	1944
No Award	1945
Boyd Harshbarger and	
D. B. DeLury (separate papers)	1946
No Award	1947
Henry Leidheiser, Jr.	1948
Walter S. Flory, Jr.	1949

[1] The winning papers in this competition were entered against those of the North Carolina, South Carolina, Georgia, and Florida Academies of Science. It was discontinued in 1940.

[2] The winning authors had the choice of the Jefferson Prize or the Academy Prize during this period. The name of the Academy Prize was changed to the J. Shelton Horsley Award; and the Jefferson Prize discontinued in 1944.

Erling S. Hegre 1950
David B. Duncan 1951
D. R. H. Gourley 1952
Stephen Berko
Frank L. Hereford 1953
Lynn D. Abbot, Jr. and Mary J. Dodson 1954

General Program of The Thirty-Second Annual Meeting 1954

UNIVERSITY OF VIRGINIA

CHARLOTTESVILLE, VIRGINIA

WEDNESDAY, MAY 5

3:00 P.M. to 8:00 P.M.——Registration for Junior Academy Members, Participants in the Science Talent Search——Main Lobby, Cabell Hall.

3:00 P.M. to 8:00 P.M.——Arranging Exhibits——Cabell Hall Basement.

THURSDAY, MAY 6

8:00 A.M. to 5:00 P.M.——Registration for Junior Academy Members, Senior Academy Members and Guests——Main Lobby, Cabell Hall.

9:00 A.M.——Meeting of Science Exhibit Judges, Science Talent Search Judges——Rooms 428, 451, Cabell Hall.

9:30 A.M.——Meeting of Chairman and Exhibitors, and Science Talent Search Participants——Cabell Hall Auditorium.

10:00 A.M. to 12:30 P.M. and 1:30 to 4:00 P.M.——Finalists of Talent Search meet with Chairman and Interviewers——Cabell Hall, Rooms 428, 451, 254, 255.

10:00 A.M. to 12:30 P.M. and 1:30 to 4:00 P.M.——Judging of Science Exhibit Contests——Cabell Hall Basement.

3:30 P.M.——Meeting of all Senior Academy Section Officers——Room 122, Cobb Chemical Laboratory.

4:00 P.M.——Meeting of the Section Editors——Room 100, Cobb Chemical Laboratory.

5:00 P.M.——Senior Academy Conference and General Meeting——Auditorium, Cabell Hall.

7:30 P.M.——Business Meeting, Junior Academy of Science——Auditorium, Cabell Hall.

8:30 P.M.——Address of Guest Speaker for Junior Academy Members and Guests——Auditorium, Cabell Hall.

9:30 P.M.——Meeting of Virginia Junior Academy of Science Committee——Cabell Hall.

FRIDAY, MAY 7

8:30 A.M.——Registration——Main Lobby, Cabell Hall.

9:00 A.M.——Section Meetings: *Agricultural Sciences*——Room 118, Cabell Hall; *Astronomy, Mathematics, and Physics*——Rouss Physical Laboratory; *Bacteriology*——Room 311, Cabell Hall; *Biology*——Maury Hall; *Chemistry*——Room 200, Cobb Chemical Laboratory; *Education*——Room 122, Cabell Hall; *Engineering*——Room 39, Thornton Hall; *Geology*——Room 244, Cabell Hall; *Medical Sciences* —— Amphitheater, Medical School; *Psychology*——Peabody Hall; *Science Teachers*——Room 122, Cobb Chemical Laboratory; *Statistics*——Room 243, Cabell Hall.

10:00 A.M. to 11:30 A.M.——Symposium, "What's New in Physics", sponsored by Science Teachers Section——Room 200, Cobb Chemical Laboratory (see program of Science Teachers Section).

12:00 Noon to 1:00 P.M.——JUNIOR-SENIOR SCIENTIST HOUR *at which Awards will be presented*——Auditorium, Cabell Hall.

2:00 P.M.——Section Meetings.

4:45 P.M. to 6:00 P.M.——The University of Virginia will be host at a tea to the Members and Guests of the Academy —— Rotunda.

7:45 P.M.——Short Business Meeting, Senior Academy —— Auditorium, Cabell Hall.

8:30 P.M.——Address by Dr. J. A. Becker, Bell Telephone Laboratories, "Seeing and Counting Atoms" with the New Field Emission Microscope"——Auditorium, Cabell Hall.

SATURDAY, MAY 8

9:00 A.M.——Section Meetings.

10:00 A.M.——Academy Council Meeting —— Conference Room, Cobb Chemical Laboratory.

Tabulation of Registration

	Section	*Members*	*Non-members*	*Total*
1.	Agricultural Sciences	15	10	25
2.	Astronomy, Mathematics, and Physics	44	32	76
3.	Bacteriology	4	1	5
4.	Biology	75	24	99
5.	Chemistry	63	48	111
6.	Education	9	4	13
7.	Engineering	14	8	22
8.	Geology	18	11	29
9.	Medical Sciences	26	10	36
10.	Psychology	29	9	38
11.	Science Teachers	13	3	16
12.	Statistics	9	13	22
	No Section Preference	18	35	53
	TOTAL	337	208	545
	JUNIOR REGISTRATION			155
			TOTAL REGISTRATION	700

MINUTES OF THE COUNCIL MEETING
MAY 6, 1954

A meeting of the Council of the Virginia Academy of Science was held in Room 02, Cobb Chemical Laboratory, University of Virginia, 2:30 P.M., May 6, 1954. Present were Walter S. Flory, President-Elect I. G. Foster, Horton H. Hobbs, Jr., Guy W. Horsley, Ladley Husted, Sidney S. Negus, Paul M. Patterson, and Foley F. Smith. President Allan T. Gwathmey presided. Boyd Harshbarger was present at the latter part of the meeting.

Dr. Guy W. Horsley discussed the auditor's report in detail and discussed details of the budget to cover the remainder of the calendar year 1954 and the tentative budget for 1955. The Council unanimously moved to recommend to the Academy Conference that all surplus funds in all Academy accounts be set up in one account with the First and Merchants National Bank of Richmond in short term securities, to earn additional income for the Academy. It was moved, seconded, and passed that the budget be accepted as submitted by the Finance Committee and recommended for approval by the Conference.

The new Business Membership Classification was discussed. Efforts will be made to secure more members in this classification.

The streamlined Academy Conference as inaugurated last year was discussed in detail as opposed to the former method of having verbal reports of all committees made at the Conference. It was decided that this question would be brought up before the Conference by President Gwathmey and left for its decision.

It was agreed that the Junior Academy activities on Friday evening could be moved up (early enough) so that the Conference could begin at 9 o'clock, if this was the desire of the majority present at the Conference.

The question of getting the program of the Annual meeting as far in advance as possible was brought up, and it was agreed that early distribution of the separate copies would greatly aid the Public Relations program of the Academy.

Boyd Harshbarger emphasized the necessity of having all abstracts and other copy for the Proceedings in his hands by May 20.

The meeting adjourned at 4 P.M.

FOLEY F. SMITH, *Secretary*

MEETING OF THE ACADEMY CONFERENCE MAY 6, 1954

The annual meeting of the Academy Conference was held in the auditorium of Cabell Hall, University of Virginia, May 6, 1954, at 5 P.M. A quorum of more than forty members being present, President Gwathmey called the meeting to order and welcomed both the Junior and Senior Academies on behalf of the University of Virginia. The reading of the minutes of the previous Academy Conference was heard.

The recommendation of Council concerning the time of the next Conference was discussed, and it was moved, seconded, and passed that the Conference next year be held after the Junior Academy activities are over.

Reports of the various committees were made. No report was received from the Fauna Committee or the Science Museum Committee.

There being no further business, the meeting adjourned at 6:05 P.M.

FOLEY F. SMITH, *Secretary*

MINUTES OF THE ACADEMY MEETING

MAY 7, 1954

The annual meeting of the Academy was held in the auditorium of Cabell Hall, University of Virginia, 7:30 P.M. President Gwathmey presided, and the reading of the minutes of the last business meeting was heard.

President Gwathmey again presented greetings to the Academy on behalf of the University, and expressed the regrets of President Colgate Darden that he could not be present.

President Gwathmey recognized Dr. Raymond L. Taylor, Assistant Administrative Secretary of the American Association for the Advancement of Science, who extended official greetings to the Academy on its thirty-second meeting, from the officers and administrative staff of the Association.

Dr. Gwathmey at this time recognized the Honorable John S. Battle, former Governor of Virginia, and expressed the gratitude of the Academy for his help in the formation of the Virginia Institute of Scientific Research and for his keen interest in science in Virginia.

William E. Trout, Jr. gave the report of the Resolution Committee. It was moved, seconded, and passed that it be received.

Ladley Husted gave the report of the Place-of-Meeting Committee and read an invitation from Dr. G. Tyler Miller, President of Madison College, Harrisonburg, to hold the next annual meeting there. It was moved, seconded, and passed that the invitation be tentatively accepted. (These reports follow the other Committee reports.)

Paul M. Patterson gave the report of the Nominating Committee in the absence of Dr. Guy W. Horsley. The following nominees were unanimously elected for the coming year: I. G. Foster, *President;* Foley F. Smith, *Secretary-Treasurer;* Walter S. Flory, *President-Elect.*

William Hinton was elected to the Council for a period of five years.

Byron N. Cooper was elected to the Council for a term of four years, filling the remaining four-year term of Walter S. Flory.

E. C. L. Miller, Secretary-Treasurer Emeritus of the Academy, was permanently elected to this office.

Walter S. Flory, Chairman of the Research Committee, gave a brief sketch of the origin of the Research Committee in 1926-1927 under Dr. J. Shelton. In 1947 the name of the Academy prize was changed to the J. Shelton Horsley Award. This year, of 225 papers presented before the Academy sections, 9 were submitted in competition for this award. Honorable mention was given to the paper presented before the Section of Agricultural Sciences by J. S. Copenhaver and W. B. Bell of the Virginia Agricultural Experiment Station on "The Production of Bovine Hyperkeratosis (X-disease) with an Experimentally Made Pellet Feed."

In 1954, the J. Shelton Horsley award was won by Dr. Lynn D. Abbott, Jr. and Mary J. Dodson of the Medical College of Virginia for their paper

presented before the section of Medical Sciences on "Inhibition of In Vitro Heme Synthesis from N^{15} Glycine by 2, 5-Dimethylbenzimidazol, 5, 6, Dimethylbenzimidazol, and Related Compounds."

Dr. Abbot gave a brief synopsis of the purpose and results obtained in this outstanding study.

1. G. Foster of the Virginia Military Institute, newly elected President, was recognized by President Gwathmey.

The business meeting adjourned at 8:25 P.M. and reconvened at 8:30 to hear a very interesting talk by Dr. Joseph A. Becker of the Bell Telephone Laboratories on "Seeing and Counting Atoms with the New Field Emission Microscope." A demonstration of this instrument was made by Dr. Shelley of the Chemical Faculty, University of Virginia, during Dr. Becker's talk.

FOLEY F. SMITH, *Secretary*

MINUTES OF THE COUNCIL MEETING
MAY 8, 1954

A meeting of the Council of the Virginia Academy of Science was held in the Conference room, Cobb Chemical Laboratory, May 8, 1954, 10 A.M. Present were Boyd Harshbarger, Horton Hobbs, President-Elect Walter S. Flory, Allan Gwathmey, Paul M. Patterson, Stanley B. Williams, and Foley F. Smith. President I. G. Foster presided and recognized Mrs. Thelma Heatwole, Chairman of the Junior Academy of Science Committee, and Edward R. Dyer, Chairman of the Science Talent Search Committee, who were present by invitation.

The Committee on Science Teaching reported that it was unable to get funds through the State Board of Education and that it was even impossible to secure from them a list of Science Teachers in the State. The possibility of the Academy securing a current list of Science Teachers was discussed.

Edward Harlow of the American Tobacco Research Laboratory of Richmond was appointed Chairman of the Long-Range Planning Committee, succeeding Marcellus Stow, who resigned.

Sidney S. Negus pointed out that the "Buddy idea" inaugurated at this meeting had drawn attention from the Scientific Man Power Committee, AAAS, the American Chemical Society, and the National Science Foundation. It was felt that this idea is highly successful and that it should be continued. Senior members in the various fields of science were selected to escort members of the Junior Academy during the Friday morning sessions.

The Council expressed its heartfelt thanks to Mrs. Heatwole and Dr. Dyer for their most excellent efforts in making the meeting of the Junior Academy and the Ninth Science Talent Search outstanding.

The Speaker's Bureau was discussed, and it was felt that the committee should be continued another year on a regional basis.

It was suggested that President-Elect Flory secure from Madison College more detailed information concerning the housing facilities and other details of the annual meeting to present at the fall meeting of the Council before the final acceptance of the invitation to meet there next May.

Boyd Harshbarger advised the Council of his appointment of Dr. Richard Irby, Jr. of the American Tobacco Research Laboratory as Advertising Manager of the Journal. It was moved, seconded, and unanimously passed that the Editorial Board and Horton H. Hobbs, Technical Editor, be officially extended the thanks and gratitude of the Council for their excellent work in the publication of the Journal. It was also moved, seconded, and passed that Malcolm Donald Coe, publisher of *The Giles County Virginian* be thanked for his efforts in publishing the Virginia Journal of Science. It was suggested that President Foster write Dr. E. C. L. Miller extending the regrets of the Academy for his absence from this annual meeting and Dr. Russell Rowlett of the Virginia-Carolina Chemical Com-

pany thanking him for his outstanding work as Chairman of the Public Relations Committee.

The meeting adjourned at 12:15 P.M.

FOLEY F. SMITH, *Secretary*

REPORT OF THE SECRETARY-TREASURER

This, the Thirty-second meeting of the Academy, is the first under the new fiscal or calendar year and officially represents the business of the Academy from April 1, 1953, to January 1, 1954. While there are still a few minor problems in connection with the change-over, I believe that the efficiency of all business affairs of the Academy will be greatly increased, and the previous confusion of having a different membership year, auditing year, and subscription year will be eliminated.

The audit and the report of the Finance committee also covers this period, but the budget will cover what has been spent since January 1, 1954, and what can be spent during the baalnce of calendar year.

The addressograph plates of the Academy were placed in the hands of a commercial mailing firm in Richmond, which has already resulted in greater service being rendered the individual sections of the Academy.

The Academy was represented at two AAAS Council metings in Boston, Mass., December 26-31, 1953, by the Secretary and represented at the AAAS Academy Conference by the Secretary, President Allan T. Gwathmey, and Mrs. Thelma Heatwole. At the morning session President Gwathmey presented a resumé of the Virginia Academy's projects and activities. Mrs. Heatwole presented a paper at the afternoon panel on Junior Academy activities.

The AAAS Council announced the appointments and acceptance of the following officers to replace the devoted services of Dr. Meyerhoff and Mrs. Gladys Keener: Dr. Dael Wolfle, former Executive Secretary and Dr. Duane Roller, Assistant Director of Research, Hughes Research and Development Laboratories, California, as Editor of publications. Dr. Paul Scherer, Executive Officer of the Carnegie Institute of Washington, was appointed Treasurer to replace Dr. Wrather, who resigned.

George W. Beadle, Professor of Biology and Chairman of the Division of Biology, California Institute of Technology, was voted President-Elect of the Association.

During the year, $2,000 of accumulated funds in the Research Fund checking account were invested and will be noted in the report of the Finance Committee.

At the November meeting of the Council, it was decided to establish a new membership classification known as a "Business Membership", dues for which are $100.00 per year. This revenue will be used for the annual operation of the Junior Academy and Science Talent Search and other purposes at the direction of Council.

Due to the activities of President Gwathmey and Dr. Guy Horsley, I'm happy to report that seven such members have been received this year as follows: Virginia Electric and Power Company, Richmond; E. I. du-Pont de Nemours and Company, Richmond; Allied Chemical and Dye Corporation, Nitrogen Division, Hopewell; A. H. Robbins Company, Richmond; Monsanto Chemical Company, Norfolk; Phipps and Bird, Inc., Richmond; and the Newport News Shipbuilding and Dry Dock Corporation, Newport News.

FOLEY F. SMITH, *Secretary.*

FINANCIAL STATEMENT
VIRGINIA ACADEMY OF SCIENCE
CONSOLIDATED FUND BALANCE SHEET
DECEMBER 31, 1953
SCHEDULE A

ASSETS

GENERAL FUND:			
Cash in Bank (Exhibit "B")		$ 2,717.26	
Investments (At Cost):			
Preferred Stocks (Market Value $2,359.00)		2,445.95	
Total General Fund			$ 5,163.21
RESEARCH FUND:			
Cash in Bank (Exhibit "C")		$ 214.86	
Due from Trust Agent—Accumulated Income Account (Temporary Investment)		2,000.00	
Total Research Fund			2,214.86
TRUST FUND PRINCIPAL ACCOUNT (Note 1):			
Cash on Deposit (Exhibit "D")		$ 440.85	
Investments (At Cost):			
United States Savings Bonds Series "F" and "G" (Market Value $6,345.00)	$ 6,337.00		
Stock Securities (Market Value $9,305.25)	7,430.29		
5% Real Estate Note (Secured by First Deed of Trust)	1,400.00	15,167.29	
Total Trust Fund Principal Account			15,608.14
TRUST FUND PRINCIPAL ACCOUNT—INVESTMENT INCOME ACCOUNT (Note 1):			
Cash on Deposit (Exhibit "E")		$ 346.25	
Total Trust Fund Principal—Investment Income Account			346.25
TRUST FUND ACCUMULATED INCOME ACCOUNT (Note 1):			
Cash on Deposit (Exhibits "F" and "G")		$ 32.13	
Investments (At Cost) (Market Value 3,448.50)		3,791.48	
Total Trust Fund Accumulated Income Account			3,823.61
			$27,156.07

LIABILITIES AND FUND SURPLUS

GENERAL FUND:		
Advance Payment on Dues	$ 409.00	
Due to the Virginia Journal of Science	166.84	
Fund Balance	4,587.37	
Total General Fund		$ 5,163.21
RESEARCH FUND:		
Fund Balance	$ 2,214.86	
Total Research Fund		$ 2,214.86
TRUST FUND PRINCIPAL ACCOUNT:		
Fund Balance, December 31, 1953	$15,608.14	
Total Trust Fund Principal Account		15,608.14
TRUST FUND PRINCIPAL ACCOUNT——		
INVESTMENT INCOME ACCOUNT:		
Fund Balance——April 1, 1953	$ 115.75	
Add——Excess of current year's income over income distribution (Exhibit "E")	230.50	
Fund Balances——December 31, 1953	$ 346.25	
Total Fund Principal Account—— Investment Income Account		346.25
TRUST FUND ACCUMULATED INCOME ACCOUNT:		
Due to Virginia Academy of Science—— Research Fund (Temporary Investment)	$ 2,000.00	
Fund Balance——April 1, 1953 $ 1,807.23		
Add——Excess of current year's income over income distribution (Exhibit "F") 16.38		
Fund Balance——December 31, 1953	1,823.61	
Total Trust Fund Accumulated Income Account		3,823.61
		$27,156.07

GENERAL FUND
STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS
FOR THE PERIOD APRIL 1, 1953, T ODECEMBER 31, 1953

EXHIBIT "B"

BALANCE ON DEPOSIT—APRIL 1, 1953			$ 2,665.95
RECEIPTS:			
Revenues:			
Dues:			
Regular Members	$ 738.00		
Collegiate Members	50.00		
Contributing Members	80.00		
Delinquent Dues for Prior Years Collected	37.00	$ 935.00	
Gifts, Grants and Bequests:			
Virginia Junior Academy of Science		500.00	
Non-Revenue:			
Advance payment of dues	$ 398.00		
Special contributions for Science Talent Search	235.00		
Collections for May 1953 meeting shown as deduction of meeting expenses:			
Sales of Booth Space	$ 90.00		
Registration Fees	247.00		
	$337.00		
Dividends from Stock Investments	79.05		
Refund on prior year's publication for Virginia Junior Academy of Science	27.91	739.96	
Total Receipts			2,174.96
			$ 4,840.91
DISBURSEMENTS:			
American Association for Advancement of Science Meeting		$ 170.00	
Junior Academy of Science		371.44	
Annual Meeting Expenses:			
Total Expenses Incurred and Paid	$ 369.02		
Proceeds from Sales of Booth Space and Registrations	337.00	32.02	

Miscellaneous General Expenses (Schedule "1")	279.74	
Postage and Express	104.71	
Printing	113.57	
Science Talent Search	786.40	
Stationery, Supplies and Stenographic Services	77.11	
The Virginia Journal of Science (Schedule "2")	128.66	
Dr. E. C. L. Miller Award	50.00	
W. Catesby Jones Award	10.00	
Total Disbursements		$ 2,123.65
BALANCE—DECEMBER 31, 1953 (Exhibit "A")		$ 2,717.26

CONSISTING OF:

Cash on Deposit First and Merchants National Bank of Richmond—Checking Account		
General Fund	$ 2,019.95	
Science Talent Search	540.84	
Virginia Junior Academy of Science	156.47	
		$ 2,717.26

RESEARCH FUND

STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS FOR THE PERIOD APRIL 1, 1953, TO DECEMBER 31, 1953

EXHIBIT "C"

BALANCE ON DEPOSIT—APRIL 1, 1953		$ 2,587.39
RECEIPTS:		
Revenues:		
Income from Trust Investments	$ 284.26	
Gifts, Grants and Bequests	100.00	
Refund on Prior Year's Grant-In-Aid	60.85	
Total Receipts		445.11
		$ 3,032.50
DISBURSEMENTS:		
Investment funds to Trust Agent, First and Merchants National Bank of Richmond	$ 2,000.00	
Grant-In-Aid Awards	800.00	
Miscellaneous Expense	17.64	
Total Disbursements		2,817.64

BALANCE ON DEPOSIT—DECEMBER 31, 1953 (Exhibit "A")	$ 214.86
CONSISTING OF:	
Cash on Deposit First and Merchants National Bank of Richmond—Checking Account	$ 214.86

TRUST FUND PRINCIPAL ACCOUNT–PRINCIPAL CASH ACCOUNT
STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS
FOR THE PERIOD APRIL 1, 1953, TO DECEMBER 31, 1953

EXHIBIT "D"

BALANCE—APRIL 1, 1953		$ 1,169.73
RECEIPTS:		
Proceeds from Federal Government Bonds maturing in August 1953	$ 1,500.00	
Proceeds from payment on principal of Real Estate First Deed of Trust Note	300.00	
Total Receipts		1,800.00
		$ 2,969.73
DISBURSEMENTS:		
Purchase of 25 Shares of Illinois Power Company Common Stock	$ 1,011.08	
Purchase of 20 Shares of America Tobacco Company Common Stock	1,517.80	
Total Disbursements		2,528.88
BALANCE—DECEMBER 31, 1953		$ 440.85
CONSISTING OF:		
Cash on Deposit with Depositary Bank of the Trust Agent, First and Merchants National Bank of Richmond		$ 440.85

TRUST FUND PRINCIPAL ACCOUNT—
INVESTMENT INCOME CASH ACCOUNT
STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS
FOR THE PERIOD APRIL 1, 1953, TO DECEMBER 31, 1953

EXHIBIT "E"

BALANCE—APRIL 1, 1953		$ 115.75
RECEIPTS:		
Revenue:		
Dividends on Stock Investments	$ 290.75	
Interest on Federal Government Bonds	131.25	
Interest on Real Estate First Deed of Trust Note	60.00	
Transfer from Trust Fund Accumulated Income Account	16.38	
Total Receipts		498.38
		$ 614.13
DISBURSEMENTS:		
Remittance to Virginia Academy of Science—Research Fund		267.88
BALANCE—DECEMBER 31, 1953 (Exhibit "A")		$ 346.25
CONSISTING OF:		
Cash on deposit with Depository Bank of the Trust Agent, First and Merchants National Bank of Richmond		$ 346.25

TRUST FUND ACCUMULATED INCOME ACCOUNT —
PRINCIPAL CASH ACCOUNT
STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS
FOR THE PERIOD APRIL 1, 1953, TO DECEMBER 31, 1953

EXHIBIT "F"

BALANCE — APRIL 1, 1953	
RECEIPTS:	
Investment from Virginia Academy of Science — Research Fund	$ 2,000.00
	$ 2,000.00

DISBURSEMENTS:	
Purchase of 55 Shares of El Paso Natural Gas Company Common Stock	$ 2,000.63
BALANCE — DECEMBER 31, 1953 (Overdraft)	$ (.63)
CONSISTING OF:	
Excess payment for stock investment over cash balance by Trust Agent, First and Merchants National Bank of Richmond	$ (.63)

TRUST FUND ACCUMULATED INCOME ACCOUNT — INVESTMENT INCOME CASH ACCOUNT

STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS

FOR THE PERIOD APRIL 1, 1953, TO DECEMBER 31, 1953

EXHIBIT "G"

BALANCE — APRIL 1, 1953		$ 16.38
RECEIPTS:		
Dividends on Stock Investments		49.14
		$ 65.52
DISBURSEMENTS:		
Remittances to Virginia Academy of Science — Research Fund	$ 16.38	
Transfer to Trust Fund Principal Account	16.38	
Total Disbursements		32.76
BALANCE — DECEMBER 31, 1953 (Exhibit "A")		$ 32.76
CONSISTING OF:		
Cash on Deposit with Depositary Bank of the Trust Agent, First and Merchants National Bank of Richmond		$ 32.76

GENERAL FUND

SCHEDULE OF MISCELLANEOUS AND GENERAL EXPENSES

FOR THE PERIOD APRIL 1, 1953, TO DECEMBER 31, 1953

SCHEDULE "1"

Auditing and Tax Service	$ 200.00
Expenses of Secretary of the Biology Section	13.75

Expenses of Secretary of the Chemistry Section	6.00
Expenses of Secretary of the Medical Science Section	9.54
Dues to A. A. A. S.	10.00
Post Office Box Rental	30.00
Telephone and Telegraph	6.43
Miscellaneous Expenses	4.02
Total (Exhibit "B")	$ 279.74

ANALYSIS OF COLLECTION FOR AND REMITTANCES TO THE VIRGINIA JOURNAL OF SCIENCE FOR THE PERIOD APRIL 1, 1953, TO DECEMBER 31, 1953

SCHEDULE "2"

BALANCE — APRIL 1, 1953		$ (321.75)
COLLECTIONS:		
Membership Dues at $2.00 each:		
263 Paid during current period		526.00
10 Delinquent Dues collected		20.00
20 Gratuitous subscriptions to Patrons, Honorary and Life Members		40.00
Collegiate Membership at $1.25 each:		
25 Paid during current period		31.25
	(1)	$ 295.50
REMITTANCES:		
April 2, 1953		$ 10.50
June 5, 1953		78.75
September 11, 1953		29.75
December 17, 1953		8.41
December 18, 1953		1.25
Total Remittances (Exhibit "B")	(2)	$ 128.66
BALANCE — DECEMBER 31, 1953 (1) minus (2)		$ 166.84

REPORT OF THE LONG RANGE PLANNING COMMITTEE

The Committee held no meetings during the past Academy year. It is recommended that the Committee on Science Teaching in the Secondary Schools of Virginia be discharged; this recommendation is made in keeping with the suggestion made by the Chairman of that Committee last year. The original studies assigned the Committee have been completed, but no action on its recommendations has been taken by the Council. The Committee on the Dismal Swamp Project reports progress, but the book on the Swamp has not been completed.

The present Chairman has held this position for five years and has recommended to the President-elect that a new Chairman be appointed.

MARCELLUS H. STOW

REPORT OF THE RESEARCH COMMITTEE

The 1954 J. Shelton Horsley Research Award was won by Dr. Lynn D. Abbott and Miss Mary J. Dodson for their outstanding paper "Inhibition of *in vitro* Heme Synthesis from N^{15} Glycine by 2,5-Dimethylbenzimidazole, 5,6-Dimethylbenzimidazole and Related Compounds." The prize winning paper was a contribution from the Biochemistry Laboratories of the Medical College of Virginia. A paper by Mr. J. S. Copenhaver and Dr. W. B. Bell, of the Virginia Polytechnic Institute, entitled "The Production of Bovine Hyperkeratosis (X-Disease) with an Experimentally Made Pellet Feed" received Honorable Mention.

During the year several requests for Research Grants-in-Aid were approved. Persons awarded these grants, with their planned study, and the amount of the grant, follow:

1. Kendall W. King, Biology Department, Virginia Polytechnic Institute. To apply on the purchase of a Bausch and Lomb Monochromatic Colorimeter for a study of "The Isolation and Physiological Characteristics of Cellulolytic Bacteria from the Bovine Rumen" as well as for use with a number of other listed studies of the same department. $150.00.

2. Jack D. Burke, University of Richmond. Miscellaneous apparatus (Roughton-Scholander Syringe, small animal scales, also animals and food for them) to be purchased to assist in carrying out Oxygen Capacity Studies in Sexual Differences in Mammals". $150.00.

3. Roger Rageot, Norfolk Museum. For field expenses in studying reptiles and amphibians of the Dismal Swamp. $200.00.

4. W. H. Lewis, Blandy Experimental Farm, University of Virginia. For field expenses in making a cytotaxonomic study of the roses of Virginia (in conjunction with a broader study of the roses of America). $200.00.

5. John Thornton Wood, University of Virginia Medical School. Expenses while doing bibliographic work at the U. S. National Museum in connection with working up data for publication compiled by the late Roy Ash. The data concerned here deal with the hatching of snapping turtles. $50.00.

WALTER S. FLORY, JR.

REPORT OF THE FINANCE AND ENDOWMENT COMMITTEE

The Finance and Endowment Committee met on April 14, 1954, and carefully considered the finances of the Virginia Academy of Science. The audit, which had been studied by each member of the Finance Committee, was approved.

It had been recommended by this committee in 1953 that the reserve and other endowment funds be turned over to a consolidated agency account at the First and Merchants National Bank. This has been done and has worked out very well. The suggestion that only about $500.00 be kept as immediately available cash and the rest being invested has been followed. We feel that this keeps the greatest possible amount of money working for the Academy and not lying idle, but in no way goes against the wishes of the Academy by tying up the funds of the Research Committee.

In the past year this committee has endeavored to find some source of greater revenue for the Academy so that it could take on the finances of the Junior Academy of Science and the Science Talent Search. We feel that this has been partially answered by obtaining business memberships at $100.00 a year. While only seven or eight of these memberships have been obtained, we hope to increase this to 20 or 25 and urgently request other members of the Academy to help in the promotion of these memberships. We feel that business and industries should be interested in the support of our activities. I am glad to say that the contacts we have made have been most encouraging.

The budget is attached and it will be noted that for the first time the budgets for the Junior Academy of Science and the Science Talent Search are included. On the lower part of the page the budget request by the Junior Academy of Science is shown. The discrepancy between the budget for the Junior Academy for 1954 and that shown in the column above is a difference of $207.47 which already has been spent by the Junior Academy in the first part of this year. I believe all the other items are self-explanatory.

The estimated income from 900 members is $3,000. The income from the seven business members is $700, making a total of $3,700. We feel certain that we can raise the remaining $517 from other business memberships which will give us a balanced budget for 1955.

GUY W. HORSLEY

BUDGET

VIRGINIA ACADEMY OF SCIENCE

	Proposed for 1953-1954	*Spent to Dec.* 31, 1953	*Budget* 1954	*Budget* 1955
A.A.A.S. Meeting	$125.00	$170.00	$125.00	$125.00
Travel expenses for representatives to meetings	200.00	———	200.00	200.00
E. C. L. Miller Award	50.00	50.00	50.00	50.00
Junior Academy of Science & Science Talent Search	225.00	371.44	925.47	710.00
		786.40	800.00	800.00
Annual meeting expenses	25.00	32.00	30.00	30.00
Audit and tax services	200.00	200.00	200.00	200.0
Audit and tax services	200.00	200.00	200.00	200.0
Premium on fidelity bond	12.50	12.50	12.50	12.50
Stationery and stenographic services	75.00	77.11	75.00	75.00
Postage	125.00	104.71	125.00	100.00
Subscriptions to Journal of Science for life and honorary members	46.00	40.00	40.00	40.00
Addressograph service	75.00	102.99	75.00	75.00
Membership subscription to Virginia Journal Science paid to Journal ($2 per member, 900 members)			1,800.00	1,800.00
Total	1,158.50	1,947.15	4,457.97	4,217.50
Junior Academy of Science				
Junior Science Bulletin			90.00	200.00
Telephone, postage, etc.			155.00	75.00
Stationery, membership cards, certificates			35.00	35.00
Prizes, promotional activities			163.00	325.00
Speaker for Spring meeting			75.00	75.00
Proposed organizational booklet			200.00	———

REPORT OF THE COMMITTEE OF THE VIRGINIA JUNIOR ACADEMY OF SCIENCE

COMMITTEE MEMBERS

Miss Mary E. Humphreys
Franklin D. Kizer
Miss Susie V. Floyd
Bruce D. Reynolds
H. Felix Sanders
Miss Vada C. Miller
E. Sherman Grable
Edward R. Dyer
Reuben R. McDaniel
D. L. Kinnear
George H. Sands

COMMITTEE MEETINGS

June 13, 1953	Thomas Jefferson Inn	Charlottesville
October 10, 1953	Thomas Jefferson Inn	Charlottesville
February 13, 1954	Thomas Jefferson Inn	Charlottesville

The Virginia Junior Academy of Science as organized for the purpose of promoting and maintaining interest in science among secondary school students. In order to carry out a program for encouraging junior scientists the following activities have been carried out during 1953-1954:

Publicity.——1. The Junior Science Bulletin, a four-page publication, was issued three times during the year and mailed to every science teacher in the state whose mailing address could be obtained. The publication of the Bulletin was made possible by a contribution of $200.00 by the American Tobacco Company Research Laboratory. The printing has been done by the Newport News High School print shop under the direction of Miss Susie V. Floyd.

2. A picture-story of the Virginia Junior Academy of Science was published in a fall issue of the Virginia Journal of Education.

3. Announcements concerning Virginia Academy of Science work and the Speakers' and Counsellors' Bureau were made at the Science Teachers' Section meeting of the Virginia Educational Association, at each District meeting of the Virginia Educational Association, and at the annual meeting of the Virginia Teachers' Association.

4. Mimeographed letters concerning the Virginia Junior Academy of Science Activities were mailed twice during the year to five-hundred high schools in the State.

Teacher-Sponsor Scholarships.—— Summer scholarships of $200.00 were again made available by the University of Virginia and the College of William and Mary as awards to two outstanding Teacher-Sponsors.

Junior Science Days.——The Committee asked five colleges to sponsor Junior Science Days. Emphasis was to be placed on greater uniformity in competition on exhibits, lectures, tours, *etc.* These schools did an excellent job. A total of 136 student exhibits were on display at the Junior Science Days; 46 individual and 10 club exhibits were qualified for entry at the May meeting of the Virginia Junior Academy of Science.

Affiliation of Clubs and Individual Memberships.——Seventy-two clubs are directly affiliated with the Virginia Junior Academy of Science; fifty-two clubs affiliated through Science Clubs of America; there are 2,563 individual memberships.

Program for May Meeting.——To make the Annual Meeting of the Virginia Junior Academy of Science of more significance to the Juniors, the following plans were made and accomplished.

1. Exhibits were left up longer to allow a longer time for better judging, and to allow Senior Members to see all of them.

2. Students were selected and were escorted by Senior scientists during a part of the day on May 7. The Senior scientists who were "buddies" with the students gave them excellent advice on their scientific careers, introduced them to the Section Meetings of the Academy, joined them during the Junior-Senior Science Hour to see the projects of the students and to see the presentation of the awards.

3. A guest speaker, Dr. Carroll M. Williams, Professor of Zoology of Harvard University, gave a very inspirational talk on the subject: "Brains and Silken Chambers."

Awards

The following awards are made by the Virginia Junior Academy of Science:

1. E. C. L. Miller Award——Woodberry Forest Science Club, Woodberry Forest, "Mouse Project"——Sponsor, Mr. John Catt
2. Major Catesby Jones Award made to the project having greatest research significance——Jane Black, James Monroe High School, Fredericksburg, "Electrostatic Separation of Titanium from Sediment"
3. Club Exhibits
   - First Place——Woodberry Forest Science Club, Woodberry Forest, Mr. John Catt, Sponsor, "Mouse Project"
   - Second Place——Armstrong High School Mathematics Club, Richmond, Miss Beatrice Harrington, Sponsor —— "Mathematical Models and Graphs"
   - Third Place——Booker T. Washington Science Club, Norfolk, Mr. John Perry, Sponsor——"Miscellaneous"
   - Honorable Mention——Newport News Science Club, Newport News, Miss Susie V. Floyd, Sponsor——"Tree of Science".
4. Individual Exhibits
   - First Place——Larry Johnson, Woodrow Wilson High School, Portsmouth——"Adrenalin Reaction"
   - Second Place——Doris Hermes, Martinsville High School, Martinsville, ——"Discharge Printing on Dacron"
   - Third Place——Walter Thomas, Kempsville High School, Norfolk—— "Wind Tunnel".

Honorable Mentions:
Emma Lou Marchant, Mathews High School, Mathews
Carolyn Evans, Martinsville High School, Martinsville
Floyd Wilson, Booker T. Washington High School, Norfolk
Allen Reynolds, Wilson Memorial High School, Fishersville
Joanna Hackman, Radford High School, Radford
Jane Black, James Monroe High School, Fredericksburg.

5. Honorary Membership in American Association for the Advancement of Science:
Eleanor O'Meara, Lane H. S., Charlottesville
Floyd Wilson, Booker T. Washington H. S., Norfolk.

6. Honorary Membership in the Virginia Academy of Science:
Allen Reynolds, Wilson Memorial High School, Fishersville
Frank Chilton, Washington-Lee H. S., Arlington.

7. Teacher-Sponsor Scholarships:
University of Virginia——Miss Delores Hoback, Martinsville H. S.
Alternate——Mr. A. B. Niemeier, Craddock H. S.
College of William and Mary——Mr. John Catt, Woodberry Forest High School.
Alternate——Miss Leslie Watkins, Andrew Lewis H. S., Salem.

The Chairman expresses sincere appreciation to Miss Floyd and the Newport News High School for the excellent work on the publication of the JUNIOR SCIENCE BULLETIN, and to the officers of the Academy and the members of this Committee for their advice and willing and able participation in the Committee's work ,and to the Senior Scientists who co-operated so whole-heartedly in the Junior-Senior "buddy" program.

MRS. B. G. HEATWOLE

REPORT OF
THE NINTH VIRGINIA SCIENCE TALENT SEARCH

The Virginia Science Talent Search is an activity of the Virginia Academy of Science that has as its objective the encouragement of talented secondary school students who are interested in science to continue their studies in college. Virginia Colleges and Universities cooperate in this program by giving special consideration to successful competitors in the Search when they award their scholarships.

The Virginia Search is limited to those secondary school seniors who the previous December have entered the National Science Talent Search, conducted by Science Clubs of America, Washington, D. C., for the Westinghouse Foundation. This year (1953-54) 105 students from 32 Virginia high schools submitted entries, consisting of (1) a science aptitude and information test, (2) high school scholastic record, (3) biographical data and questionnaire filled out by the teacher-sponsor, and (4) a brief essay or report on a scientific project, activity, or subject. The number of entries is somewhat smaller than last year, in spite of the fact that

an effort was made to publicize the Search in November by mailing two bulletins to all schools and individual teachers where known, calling their attention to the Search and the scholarship program.

In March, after the entry papers were received from the Science Clubs of America, the marks on items (1) and (2) above were tabulated, biographical data and questionnaires were evaluated by members of the Committee, and the essays were read by members of the University of Virginia Science Faculties. On the basis of these entries 45 finalists (including the four National Honorable Mentions) were selected and invited with their sponsors to attend the Annual Meeting of the Academy. Forty-three finalists and 18 sponsors were able to attend, and the Academy reimbursed their travelling expenses to the amount of four cents per mile.

At the meeting, finalists were interviewed by four three-man panels composed of members of the Committee and scientists invited from the faculties of Virginia Colleges and Universities. The results of these interviews were combined with the written records to pick fifteen Winners, the other thirty finalists automatically gaining Honorable Mention.

WINNERS

°*These students won National Honorable Mention.*

Herbert S. Bennett, Washington-Lee H. S., Arlington
Jane R. Howard Black, James Monroe H. S., Fredericksburg
Robert N. Bolster, Washington-Lee H. S., Arlington
Edward A. Branch, Craddock H. S., Portsmouth
°Frank McG. Chilton, Washington-Lee H. S., Arlington
Richard L. Hartman, Maury H. S., Norfolk
°Doris Jean Hermes, Martinsville H. S., Martinsville
Robert E. Jordan III, Halifax County H. S., South Boston
Ronald G. Kinzie, Wilson Memorial H. S., Fishersville
Michael W. Konrad, Washington-Lee H. S., Arlington
James V. Mageean, Norview H. S., Norfolk
Arthur D. Old, Maury H. S., Norfolk
°Eleanor W. O'Meara, Lane H. S., Charlottesville
Allen H. Reynolds, Wilson Memorial H. S., Fishersville
°Floyd Wilson, Booker T. Washington H. S., Norfolk.

HONORABLE MENTION

Harman W. Agnew, Jr., Floyd H. S., Floyd
Donnie C. Bendall, John Marshall H. S., Richmond
Margaret L. Bowes, Huntington H. S., Newport News
Robert Lee Brand, Robert E. Lee H. S., Staunton
James P. Charlton, Buckingham Central H. S., Buckingham
Horace Eldridge Curlis, Jr., John Marshall H. S., Richmond
Carolyn S. Evans, Martinsville H. S., Martinsville
Edvin V. Farinholt, Lane H. S., Charlottesville

Norma Ellen Halmagyi, Thos. Jefferson H. S., Richmond
Richard F. Harrington, Granby H. S., Norfolk
Diane E. Harris, Armstrong H. S., Richmond
Henry H. Harris, Jr., Lane H. S., Charlottesville
David E. Haught, Culpeper H. S., Culpeper
Edward S. Jones, Carter G. Woodson H. S., Hopewell
Michael F. Kavanaugh, Jefferson Senior H. S., Roanoke
Margaret J. Lilly, Dublin H. S., Dublin
Robert C. Lyne, Jr., Thos. Jefferson H. S., Richmond
Barbara Anne Miller, Thos. Jefferson H. S., Richmond
Jesse H. Motes, Washington-Lee H. S., Arlington
Lillie Mae Parker, Southampton County Tr. Sch., Courtland
Richard B. Perry, Jefferson Senior H. S., Roanoke
Robert C. Richardson, Washington-Lee H. S., Arlington
Florence E. Robey, Andrew Lewis H. S., Salem
John A. Rosado, Washington-Lee H. S., Arlington
Furman L. Sheppard, Jr., Norview H. S., Norfolk
Edwin Lee Showalter, Jefferson Senior H. S., Roanoke
Richard H. Skeppstrom, Woodrow Wilson H. S., Portsmouth
William D. Vick, John Marshall H. S., Richmond
James A. Weinstein, Washington-Lee H. S., Arlington
Edward Wiles, Jr., John Marshall H. S., Richmond.

The names of these students have been sent with the endorsement of the Virginia Academy of Science to all Virginia Colleges and Universities and to all out-of-state institutions where the students are known to have applied for admission or financial aid.

The Chairman is happy to have this opportunity to make the following grateful acknowledgments: to President Gwathmey for encouragement and advice as well as the use of his office staff and facilities; to the presidents and officers of Virginia colleges and universities for their interest in the scholarship program; and to the Committee members and guest judges for their cheerful help.

EDWARD R. DYER, JR.

REPORT OF THE MEMBERSHIP COMMITTEE

As of March 15, 1954, the membership of the Academy was made up as follows:

Regular members	767
Business members	5
Contributing members	67
Sustaining members	27
Life or honorary members	18
Patrons	3
Student members	48
Total	935

All members in arrears in dues for more than one year had been dropped from membership shortly after the first of the year.

During the period, May 1 – December 31, 1953, new members were obtained as follows:

Regular members	42
Contributing members	1
Student members	13
Total	56

HENRY LEIDHEISER, JR.

JAMES RIVER PROJECT

The sale of the monograph on "The James River Basin — Past, Present, and Future" continues to be steady though certainly not lively. During the past year, copies have been bought by libraries, both domestic and foreign, by individuals and by bookdealers. Herewith is the financial statement for the year 1953-54.

SUMMARY AS OF MAY 5, 1954

Total copies distributed as of April 30, 1953	511
Balance on deposit, Peoples National Bank, Lexington, Va., as of April 30, 1953	$1,657.90
Complimentary copies distributed between May 1, 1953, and May 5, 1954	3
Copies sold, payment received at $6.00, between May 1, 1953, and May 5, 1954 — 16 copies	$ 96.00
Copies sold, payment due, between May 1, 1953, and May 5, 1954	0
Total copies distributed between May 1, 1953, and May 5, 1954	19
Total cash received between May 1, 1953, and May 5, 1954	$ 96.00
Deposited in bank between May 1, 1953, and May 5, 1954	$ 96.00
Expenditures charged to Monograph account between May 1, 1953, and May 5, 1954	$ 0.00
Net balance in Peoples National Bank from sales May 1, 1953, and May 5, 1954	$ 96.00
Total balance in Peoples National Bank from sales May 11, 1950, to May 5, 1954	$1,753.90
Total copies distributed May 11, 1950, to May 5, 1954	530

MARCELLUS H. STOW

REPORT OF COMMITTEE ON RESOURCE USE EDUCATION, VIRGINIA ACADEMY OF SCIENCE

Interest in resource use education matters in Virginia has remained active during the past year, even increased in certain phases, as adjudged by those engaged in conservation education extension work.

The Governor's office set aside two separate periods during the year for the focusing of attention on conservation: *Conservation Week* set aside in October, and *Wildlife Restoration Week* in March.

The Commission of Game and Inland Fisheries reports that interest in the conservation essay contest is growing yearly and that in the seven years that the project has been held in the schools, more than 75,000 young people have been taught grass-roots conservation as a result. Resource use education has also been stressed by other state resource agencies, particularly the Commission of Fisheries, Virginia Forest Service, State Water Control Board, Virginia Extension Service, and others.

Several summer workshops in resource use were held in the State. Radford State Teacher's College had a two-week course for teachers in July. At the Virginia Fisheries Laboratory a one-week course in seafood conservation was given a group of agricultural teachers in July.

Interest in two other teachers workshops was indicated, namely at Richmond Professional Institute and at Bridgewater College, but because of too few students the workshops were not held.

Many of the Committee's members played an active role in the deliberations of the Virginia Resource Use Education Council, which met twice during the year, and whose broad objectives closely parallel those of the Committee.

One Committee meeting was held during the year, with the group assembling in Richmond on March 29. Those in attendance were: Elizabeth Perry, J. W. O'Byrne, William C. Kellner, Max Carpenter, Ross H. Walker, T. V. Downing, R. A. Bailey, Harry M. Jopson, E .W. Mundie, D. S. Wallace, and J. J. Shomon.

At this meeting the broad objectives of the Committee were reviewed and reaffirmed. A sub-committee was appointed to meet with the State Superintendent of Public Instruction to aid in accomplishing the objectives of the Committee (see 1952 and 1953 Committee reports.)

The group also gave its endorsement to the Game Commission's essay contest, urged more conservation symposia at different meetings throughout the State, and lent its support to a move to establish a creditable Museum of Natural History for the Commonwealth.

The chairman wishes to express deep appreciation for the cooperation received from the officers of the Academy and the members of the Resource Use Education Committee. What progress has been made by the Committee has come as the result of this very fine and generous assistance.

J. J. SHOMON

REPORT OF THE COMMITTEE ON VIRGINIA FLORA

Efforts to have a meeting of the committee during the year have not been successful, the members of the committee being widely scattered. Members of the committee have been active in publications and field work. Dr. Paul M. Patterson continues to be especially active in field work and publications relative to the mosses of the State. Some progress has been made in the development of an annotated check list giving data on distribution and ecology of the species. This is to be continued with the hopes of early completion. The new edition of Gray's Manual being expensive and the Key unsatisfactory for students' use, it presents a challenge to the committee to push its work towards the development of a State flora.

Members of the committee have given illustrated lectures relative to native plants and conservation.

A. B. MASSEY

REPORT OF THE SPEAKERS AND COUNSELORS COMMITTEE

This committee operated on a very limited basis in keeping with the suggestion of the President of the Academy.

Members of the science faculties of Bridgewater College, Eastern Mennonite College, and Madison College participated in the work of the Committee. Talks and demonstrations were made to a number of high school assemblies, science clubs, and science classes. The geographical area covered extended from Arlington County to Augusta County.

The groups who have been served by the Speakers and Counsellors Committee have been most appreciative and have said that the speakers who visited them have done much to stimulate interest in science.

It is believed that this Committee can do a tremendous amount of good in disseminating scientific information and in evoking interest in science. It should be continued if possible. It should, however, be mentioned that it is often difficult for faculty members to leave their institutional responsibilities in order to speak to school groups and other organizations. Also the matter of transportation is frequently a problem. In making the decision concerning the future of this Committee the matter of the availability of speakers should receive primary consideration. The desire on the part of the schools to have the speakers has been quite evident to the Chairman of this Committee.

PERCY H. WARREN

REPORT OF THE COMMITTEE ON RESOLUTIONS

The Committee on Resolutions wishes to present the following resolutions for your approval.

1. BE IT RESOLVED, that the Virginia Academy of Science express its grateful appreciation to its host, the University of Virginia, and to its President, Colgate W. Darden, Jr., for its gracious hospitality.

2. BE IT FURTHER RESOLVED, that members of the Local Committee on Arrangements, under the chairmanship of Dr. Frederick W. Young, and all other University personnel who assisted, be commended for the excellence of their many contributions to the success of this Thirty-Second Annual Meeting of the Virginia Academy of Science.

3. BE IT FURTHER RESOLVED, that the Virginia Academy of Science commend the staff of the Virginia Journal of Science for the outstanding work performed.

4. BE IT FURTHER RESOLVED, that the Virginia Academy of Science recognize the interest and contributions of its members, particularly Mrs. B. G. Heatwole and Dr. Edward N. Dyer, to making the junior science program so effective.

5. BE IT FURTHER RESOLVED, that the Virginia Academy of Science express its gratitude for past services and record its tribute to the esteemed members who have been lost by death during the past year.

Dr. Roy Philip Ash
Dr. H. B. Derr
Dr. Fred A. Dove
Dr. Carroll Cephas Flora
Dr. Douglas Southall Freeman
Dr. A. W. Hurd
Dr. John Lloyd Newcomb
Dr. M. Pierce Rucker
Dr. James Henderson Smith

WILLIAM E. TROUT, JR

REPORT OF THE
VIRGINIA INSTITUTE OF SCIENTIFIC RESEARCH

The Research Institute is now in its fifth year, and it is believed that the most significant contribution of the past year has been the publication of three papers by Dr. Leidheiser and his group working in the field of metal surfaces. Two were in the Journal of the Electrochemical Society and one in the Journal of Chemical Physics. A fourth paper is now in preparation. Dr. Leidheiser has also recently been invited to present a paper to a special conference in England in the field of electrochemistry.

The calibre of any scientific institution must ultimately be evaluated by its contribution to scientific knowledge, and it is now gratifying that the efforts of all those who have supported the Institute —— especially those actually engaged in the research —— are now bearing fruit.

It will be remembered that the ultracentrifuge and the electron microscope were put into operation in 1952. These are highly specialized instruments, and it is fair to say that during the past year, Dr. Likes has

become an experienced researcher with the centrifuge and Mr. von Gemingen with the electron microscope. During the past year, Mr. von Gemingen attended a brief course on electron microscopy at Cornell. Interesting and surprising results are now being obtained with both of these instruments. An electrophoresis unit for the determination of molecular weights and a thermal diffusion unit for the separation of molecules of different sizes and shapes have been recently purchased with the aid of a gift from the E. M. Todd and Company of Richmond.

Several new studies were begun during the year: one on the determination with the ultracentrifuge of the cholesterol content of blood of patients suffering with coronary and diabetic diseases. Interesting studies were initiated by Dr. Krug on the growth of organic crystals in the hope of using these crystals for a better understanding of the mechanism of organic reactions. It is hoped in the near future to continue preliminary studies made about a year ago on the molecular weight of protein molecules in tobacco.

At the present time, there are nine members of the permanent staff and seven part-time workers. The total income for the year was $84,916.00.

The staff of the Institute would be very pleased to have members of the Academy visit the Laboratory at any time.

ALLAN T. GWATHMEY

FINANCIAL STATEMENT
VIRGINIA JOURNAL OF SCIENCE

VIRGINIA POLYTECHNIC INSTITUTE

STUDENT ACTIVITIES OFFICE

OPERATION STATEMENT FOR THE FISCAL YEAR

Virginia Journal of Science

April 10, 1953, to May 3, 1954

Receipts:

Academy Subsidy	
Regular members 951 at $2.00	$ 1,902.00
Student members 66 at $1.25	82.25
Advertising	518.80
Subscriptions	502.02
Extra pages	55.48
Miscellaneous	7.00
TOTAL OF ALL RECEIPTS	$ 3,067.55

Reprints	$ 210.50
Printing of Journal	2,263.40
Postage	153.12
Engraving	121.80
Office Supplies	57.00
Miscellaneous	33.20
Printing of Index	39.00
Composition of Article	105.85
TOTAL OF ALL EXPENDITURES	$ 2,983.87
NET AMOUNT	83.68

STATEMENT OF CASH ACCOUNT

Balance of cash at beginning of year	$ 3,160.57
Total receipts for year	3,067.55
Total cash on hand during year	6,228.12
Total expenditures for year	2,983.87
Balance of cash at end of year	$ 3,244.25

Audited by: Joe W. Guthridge Date: May 5, 1954

VIRGINIA JOURNAL OF SCIENCE
STATEMENT OF ACCOUNTS RECEIVABLE

May 5, 1954

Monroe Calculating Machine Company		$ 17.50
January 1953 issue		
Eastern Advertising Agency		
September 1953 issue	$ .50	
January 1954 issue	24.90	
April 1954 issue	24.90	50.30
Marchant Calculator		9.80
April 1954 issue		
Cardinal Products		29.40
April 1954 issue		
Dombrower Advertising Agency		24.90
April 1954 issue		
		$131.90

Audited by: Joe W. Guthridge Date: May 5, 1954

MINUTES OF SECTION OF AGRICULTURAL SCIENCE [1]

H. MARSHALL CLARK, *Chairman*
RODNEY C. BERRY, *Vice-Chairman*
R. W. ENGEL, *Secretary*
WESLEY P. JUDKINS, *Section Editor* (1956)

FRIDAY, MAY 7, 1954 — 9:00 A.M. — ROOM 118, CABELL HALL

1. THE RELATIONSHIP OF BROWSE TO DEER WEIGHTS IN BATH COUNTY, VIRGINIA.

R. J. Muncy; *Virginia Cooperative Wildlife Research Unit*, Blacksburg.

Studies of white-tailed deer herd conditions throughout the Commonwealth of Virginia have been initiated as the basis of future deer management. The deer herd in Bath County, Virginia, was believed to be out of balance with its habitat; therefore, detailed range and deer population data were desired.

Samples of the 1953 deer kill for Bath County were classified into two groups based on determined differences in populations of the two regions from which they were obtained. A significant difference was obtained between the average weights and body measurements of deer from the two regions in 8 of 15 tests, and a very significant difference was obtained in 6 of the 15 tests. Range conditions indicated that the higher populated area, with smaller deer body sizes, had less available browse and lower quality browse species present. Browse utilization studies indicated greater browse utilization in the higher deer population area. All phases of this investigation indicate that a high deer population depletes the vegetation both as to quantity and quality, and that this influence of the deer upon the vegetation is reflected to a measurable degree by body sizes of the deer from those ranges.

2. ECOLOGICAL SUCCESSION ON ABANDONED FARMLAND IN CUMBERLAND COUNTY, VIRGINIA — ITS RELATIONSHIP TO WILDLIFE MANAGEMENT.

Mitchell A. Byrd; *Virginia Cooperative Wildlife Research Unit*, Blacksburg.

The problem of land abandonment in Virginia has reached considerable magnitude in the past thirty years. At present, there are approximately two and one half million acres of this idle land within the boundaries of the State. The natural habitats on these lands are in a constant state of flux, as they are undergoing a series of slow but well defined stages.

This study was an analysis of some of the changes which take place in wildlife habitat on abandoned cropland fields over a period of years

and the effects of these changes on the general population of cottontail rabbits and bobwhite quail. The principal objective of the study was the determination of the trend of natural plant succession on abandoned cropland fields in the Piedmont Region of Virginia and the interpretation of this information in terms of practical wildlife management. If these successional data are accurately analyzed, they may indicate in general what has happened, is happening, or may be expected to happen on much of the approximately two and one half million acres of abandoned land in the State of Virginia.

3. RABIES IN VIRGINIA AND ITS ECONOMIC EFFECT ON AGRICULTURE.

John C. Jones: *Fish and Wildlife Service, Department of Interior*, Richmond.

Rabies is an old disease but our knowledge of it is still inadequate. Usually it is thought of only in terms of dogs. The connection between its presence in wildlife and losses in livestock receives little attention and is poorly understood. Over the past two years, it is conservatively estimated that in Virginia losses in livestock must total more than a million dollars. Foxes may play an important part in the spread of rabies.

It is difficult to discuss rabies in terms of an epidemic. To the public the term connotes great numbers of cases. Yet, the actual presence of a few proven cases is a very real danger signal.

A comprehensive control program includes vaccination of pets, rounding up of all stray dogs and cats, and reduction of the fox population. These should be started promptly upon detection of the disease, and should be accomplished within a 3-month period. A 75 percent coverage of each phase should be the minimum objective.

With reference to the foxes, the target is the disease, not the animal. The resulting healthy stock is a far greater contribution to conservation than allowing a poor and disease-ridden population to exist.

4. THE PRODUCTION OF BOVINE HYPERKERATOSIS (X-DISEASE) WITH AN EXPERIMENTALLY MADE PELLET FEED.

Jack S. Copenhaver and Wilson B. Bell: *Virginia Agricultural Experiment Station*, Blacksburg.

Calves fed pellets made when the pellet mill was lubricated with a lubricant that did not contain highly chlorinated naphthalenes did not develop symptoms and lesions of bovine hyperkeratosis. Calves fed pellets made when the pellet mill was lubricated with a lubricant containing highly chlorinated naphthalenes developed symptoms and lesions of bovine hyperkeratosis.

5. RUMEN INOCULATION IN BEEF CALVES.

F. S. McClaugherty and C. M. Kincaid: *Virginia Polytechnic Institute*, Blacksburg.

Twenty-four steer calves, approximately three to four months of age

from one herd of cattle and sired by one bull, were fed to determine the effect of artificial rumen cultures and direct rumen withdrawals on the rate of gain and efficiency of feed consumption by calves. In the first phase of the experiment, there were two replicates with four treatments each: (A) Culture made from material taken from the rumen of a fast-gaining steer at slaughter, (B) culture made from material taken from the rumen of a slow-gaining steer, (C) a commercial rumen culture, and (D) control. The feeding tests showed that the differences in rate of gain and also in feed consumption were no larger than would be expected due to chance alone.

6. PERFORMANCE TESTING OF BEEF CATTLE ON THE FARM.

J. E. Grizzle, C. M. Kincaid, and Curtis Mast; *Virginia Polytechnic Institute*, Blacksburg.

In cooperation with the Virginia Aberdeen Angus Breeders Association, the Experiment Station and Extension Service of the Virginia Polytechnic Institute started a program in January, 1953, to test the feasibility of measuring performance of beef cattle on the farm of the breeder. A total of 353 calves in 12 herds owned by nine breeders were weighed, graded, and indexed. All calves born during the year in each herd were included in the work. Indexes based on weight for age and type score were computed for each calf at six and 12 months of age. The herds were scattered over seven different counties, and each herd was visited three times. It was concluded from this pilot work that this kind of program for beef cattle breeders could be achieved, and it was expanded to include breeders of the three major breeds of beef cattle. On May 1, 1954 ,there were enrolled in the Virginia Beef Cattle Record of Performance 34 breeders with over 625 calves.

7. VARIATIONS IN THE LENGTH OF GESTATION PERIODS IN DAIRY CATTLE.

Paul M. Reaves, *Virginia Polytechnic Institute*, Blacksburg.

The length of the gestation period in dairy cattle has been reported to vary from 276.2 to 290.9 days. The range has varied from below 245 days to 305 days.

Factors influencing the length of the gestation period include: breed, sex, multiple births, sires, cow families, age of dam, and season of the year.

A study was made of 685 gestations culminating in normal calvings over a 6-year period for the 3 breeds in the Virginia Polytechnic Institute herd. The average length of gestation periods was 278.3 days for Jerseys, 279.9 for Holsteins, and 285.7 days for Guernseys.

Variations in length of time according to the sex of the calf showed that the male calves were carried longer than the heifer calves.

Twin calves occurred in 2.5 per cent of the time. Twins were carried 5 to 7 days less than single calves.

The seasonal influence was variable.

Calves sired by different sires were carried on the average for different lengths of time.

8. SUBSTITUTION RELATIONSHIPS BETWEEN GRAIN AND FORAGE IN MILK PRODUCTION.

Carl W. Allen; *Virginia Agricultural Experiment Station*, Blacksburg.

Knowledge of how one feed will take the place of another in the ration is important in determining the least cost combination. Considering the cow's inherent ability to produce milk and her capacity for different feeds, the substitution ratio between the feeds must be equal to the price ratio (inverse) for a minimum cost ration.

Using comparable feed and production records from six State Experiment Stations, several functional relationships between inherent ability, feed inputs and milk output have been studied through regression techniques. They all show rather conclusively that forage (or grain) substitutes at a diminishing marginal rate for grain (or forage) in producing a given output of milk. For the given output of milk, as more and more forage (or grain) is included in the ration, each successive pound of additional forage (or grain) takes the place of less and less grain (or forage.) Also, these regression equations (production functions) indicate that these substitution relationships between grain and forage change in going to a higher level of output from a cow of given inherent ability. Forage is worth less and less in terms of grain with increased production from the cow of given inherent ability.

9. CORRELATION BETWEEN BLOOD LEVELS OF CAROTENE AND VITAMIN E IN DAIRY COWS IN SELECTED HERDS IN VIRGINIA.

W. N. Linkous, N. O. Price, W. B. Bell, W. A. Hardison, and R. W. Engel; *Virginia Agricultural Experiment Station cooperating with the Virginia Artificial Breeders' Association.*

In an experiment designed to establish whether or not the nutritional status of dairy cattle, as measured by nutrient blood levels, could be related to their breeding efficiency, analyses were conducted on blood plasma for carotene and tocopherols at three-month intervals between July, 1953, and February, 1954. Seasonal changes in the blood levels of these nutrients were observed. In July and October, 1953, when the herds had access to fresh forage their carotene concentration was high composed to the values observed in February, 1954, when the feed consisted of conventional winter rations of hay, silage, and concentrate. Observations on a total of 45 Guernsey dairy cows at the three seasons (summer, fall, and winter) revealed a significant positive correlation between blood-circulating carotene and tocopherols ($r = .568$). In 70 Holstein cows the positive correlation between levels of these nutrients in plasma were likewise significant ($r = .586$). It is believed that these correlations reflect the nutrient intake level and that the level of feed tocopherol declines with decline in quality of roughage as is well known to occur with carotene.

10. PROBLEMS IN THE CORRELATION OF SOIL TESTS WITH CROP RESPONSE IN VIRGINIA.

Russell K. Stivers and C. I. Rich; *Virginia Agricultural Experiment Station*, Blacksburg.

Rapid soil test results for available phosphate and potash, and crop response data to phosphate and potash fertilization on two different experimental fields in Virginia are reported. Some of the soil test data were closely correlated with crop response while others were not. Such difficulties have been reported by workers in other states. They may be related to differences in feeding ability of different crops, failure to thoroughly characterize the soil, differences in climate, or differences in time of sampling.

Peanut plant chemical composition data were presented with soil test results from the areas on which the peanuts were growing. Increasing amounts of available potassium in the soil were shown to be associated with a decreasing percentage of calcium and an increasing percentage of potassium in the peanut leaves. The available calcium in the soil, however, showed no relation to the percentage of calcium in the peanut leaves. These relationships show that correlation of soil tests with crop response is intimately tied to problems in plant nutrition.

11. STUDIES OF THE PARASITISM OF *Cercospora arachidicola* HORI AND *Cercospora personata* (B. AND C.) ELL. AND EV.

Lawrence I. Miller; *Virginia Agricultural Experiment Station*, Holland.

A peanut leafspot survey made in ten Southern States indicated that *Cercospora arachidicola* was more prevalent than *Cercospora personata*. It was found that the two *Cercospora* species are composed of countless biotypes which are similar morphologically, but which may be distinguished by their cultural characteristics and their differences in pathogenicity. Since mutation does occur in culture, it is probable that it plays a role in the formation of new biotypes. The studies made of several races of the two species of *Cercospora* indicate that races of *C. arachidicola* form conidia, infect, allow lesion development, and cause leaf shedding over a wider range of temperatures and at a higher temperature optimum than do races of *C. personata*. It was found that under certain conditions nodulation, plant nutrients, and injury of insects and nematode pests affect the relative resistance rating of the plants to leafspot. Conditions which promoted early maturity generally increased the relative susceptibility rating, while conditions which delayed maturity resulted in a relatively higher resistance rating. Generally, resistance to the leafspot disease allows a plant to grow longer, because the intensity of the disease is not great enough to cause premature ripening.

12. WEATHER INFLUENCES ON EVAPORATION.

J. M. Johnson; *Virginia Agricultural Experiment Station*, Blacksburg.

The influences of air temperature, relative humidity, wind velocity, and sun intensity on evaporation rates were studied in relation to potato harvest.

Sun intensity was measured by the elevation above air temperature of a white painted tube of a soil thermograph exposed directly to the sun. The effect of all factors was measured by recording the distilled water evaporated from a Livingston white globe, porous porcelain atmometer bulb.

Air temperature and relative humidity were combined by use of hygrometric tables into one factor, vapor pressure deficit.

Vapor pressure deficit was most closely associated with evaporation rates, explaining 48 of the 77 percent of the variation in evaporation rates explained by all factors. Wind velocity was next most important, explaining 18 percent; and sun intensity explained 11 percent.

The regression equation resulting from the linear multiple correlation analysis was:

$$X_1 = 2.527737 + (.257644 \pm .018652)\ X_2 + (.166346 \pm .024781)X_3 + (.440121 \pm .024889)\ X_4$$

in which:

X_1 = Evaporation in three hours (cc., H_2O)

X_2 = Miles of wind in three hours

X_3 = Sun intensity (Soil tube temperature minus air temperature)

X_4 = Vapor pressure deficit (mbhg)

The rank of importance of the individual factors in influencing variation in evaporation was in general the same as for all areas combined.

13. THE IMPORTANCE OF WEEDS AND THEIR CONTROL IN TODAY'S AGRICULTURE.

W. E. Chapell, Plant Physiologist; *Virginia Agricultural Experiment Station*, Blacksburg.

Annual losses to farmers in the United States due to weeds are estimated at $5,000,000,000; a figure higher than combined insect and disease losses. Weed losses include (1) increased cultivation costs, (2) lowered crop yields due to direct competition for water, light, and nutrients, (3) lowered quality of crops due to presence of weed seeds and other debris in certain crops, and (4) acting as hosts for many crop insects and diseases.

Control of weeds in crops by the use of herbicides was practically nonexistent prior to 1944 when the selective weed-killing ability of 2, 4-D was discovered. Since this discovery, thousands of new compounds have been synthesized and tested on weeds and crop plants. Herbicides are divided into those that kill plants on contact and those that kill by disrupting the normal metabolic activity as they are translocated throughout the plant. In each of these groups are chemicals that will selectively kill

weeds in certain crops. This selectivity is based on physical and chemical composition of the herbicide, the physical and chemical make-up of crops and weeds, stage of development of crop plants and weeds, dosage level, timing and placement of the application, or a combination of any of these factors.

14. THE BROMIDE CONTENT OF THE PEANUT PLANTS FROM SOIL TREATED WITH ETHYLENE DIBROMIDE FOR STING NEMATODE CONTROL.

R. W. Young, L. I. Miller, and R. W. Engel; *Virginia Agricultural Experiment Station,* Blacksburg.

Ethylene dibromide, applied broadcast at the rate of 21 pounds per acre with a shank applicator at a 6-inch depth, will effectively control the sting nematode (*Belonolaimus gracilis Steiner*) and correct the stunted plant disorder. Yields of better quality nuts and hay are profitably increased by controlling the sting nematode. The bromide content of peanut kernels grown in fumigated soil is not significantly increased. No adverse flavor was imparted to kernels. Cured hay from untreated plots ranged from 40 to 90 ppm. total bromide; from fumigated plots 139 to 146 ppm. total bromide. Peanut plants readily absorb bromide ions, and the bromide content of soil from areas fumigated with ethylene dibromide (21 to 35 lb. rate) may be lower than that of untreated areas at the end of the growing season. The more prolific root systems of plants in fumigated soil may absorb more bromide than the stunted roots of plants in untreated, sting nematode infested soil. The increase of bromide in peanut hay from treated areas is not expected to have a harmful effect when consumed by farm animals. A study is in progress, however, to evaluate the effect of feeding the hay from treated areas to cows.

15. NATURE OF INSECT RESISTANCE TO CHEMICAL POISONS.

James McD. Grayson; *Virginia Agricultural Experiment Station,* Blacksburg.

Insect resistance to chemical poisons has become an increasingly important problem during the past forty-five years. An analysis of this problem reveals a complex of independent and interesting factors which rather logically can be grouped as follows: physiological, genetical, and behavioristic. The so-called "resistance" of the California red scale to HCN, and the codling moth to lead arsenate, are apparently attributable to factors other than actual tolerance to the chemical poisons involved. True tolerance to DDT in many insect species is attained through some detoxification process, the details of which are not fully known.

16. AN IMPROVED PROCEDURE FOR THE DIRECT ISOLATION OF CELLULOLYTIC RUMEN BACTERIA.

Paul H. Smith and K. W. King; *Virginia Polytechnic Institute,* Blacksburg.

Direct isolation of celluloytic rumen bacteria may be achieved by modifying the procedures which Huhtanen and Gall (1952) proposed for rumen

bacteria in general. The rumen fluid supplement has been refined. Cellulose decomposing bacteria are detectable by clear zones surrounding their colonies when water-insoluble cellulodextrins are incorporated in the medium. Preliminary observations on some of the isolates from the Virginia Polytechnic Institute herds as well as data indicating the usefulness of the modified procedure are included.

17. REFINEMENTS IN PLATE COUNTING PROCEDURES FOR CELLULOSE DECOMPOSING SOIL MICROORGANISMS.

J. D. Castro and K. W. King; *Virginia Polytechnic Institute*, Blacksburg.

Media used for both isolation and plate counts of cellulolytic soil microorganisms up to now have contained only ammonia or nitrate as nitrogen sources. Consequently organisms possessing even a single nutritional requirement for organic nitrogen have not been detected. Established procedures for obtaining plate counts of cellulolytic soil bacteria have been modified by (1) inclusion of organic nitrogen, (2) revision of the procedure for preparation of water-insoluble cellulodextrin, and (3) addition of sparking amounts of cellobiose to the medium. Data indicating the enhanced sensitivity of the new medium are presented.

BUSINESS MEETING

The annual business meeting was held at the close of the scientific session. The following were elected to serve as officers of the section for the 1954-55 period:

Chairman——Rodney C. Berry, Director and State Chemist, Department of Agriculture and Immigration, Richmond.

Vice-Chairman——R. W. Engel, Department of Biochemistry and Nutrition. Virginia Polytechnic Institute, Blacksburg.

Secretary——Paul M. Reaves, Department of Dairy Husbandry, Virginia Polytechnic Institute, Blacksburg.

Section Editor——Wesley P. Judkins, Department of Horticulture, Virginia Polytechnic Institute, Blacksburg.

The desirability of including a new section in *The Virginia Journal of Science* was discussed. The section members voted to recommend to the Board of Editors of *The Virginia Journal of Science* that they would favor publishing annually in the Proceedings Issue a list of titles, authors, and references of scientific contributions (Publications in Scientific Periodicals) by scientists residing in Virginia.

MINUTES OF THE SECTION OF ASTRONOMY, MATHEMATICS, AND PHYSICS [2]

H. V. LOH, *Chairman*
T. E. LOTHERY, *Secretary*
F. L. HEREFORD, *Section Editor*

FRIDAY, MAY 7, 1954—10:00 A.M.—ROUSE PHYSICAL LAB.

1. APPLICATION OF THE POWER SERIES TRANSFORM TO DIFFERENCE EQUATIONS IN ENGINEERING.

Leonard McFadden; *Virginia Polytechnic Institute.*

The Power Series Transform of a sequence (y_k) is defined as $P(y_k) = \bar{y}(s) = \sum_0^\infty y_k s^{-k}$. A table has been compiled listing certain functions and their transforms. In particular $P(y_{k+n}) = s^n y - s^n \sum_0^{n-1} y_k s^{-k}$ by means of which the linear difference equation $y_{k+2} + by_{k+1} + c\ y_k = f_k$ with constant coefficients can be transformed into $(s^2 \bar{y} - s^2 y_0 - s y_1) + f(s \bar{y} - s y_0) + c \bar{y} = \bar{f}$, from which it follows $y = \dfrac{\bar{f} + (s^2 + bs)\, y_0 + s y_1}{s^2 + bs + c}$. By means of the table (y_k) can be found. The method is applied to certain difference equations in engineering.

The method is shown to be useful in solving linear difference equations with variable coefficients. From the list $P(k\ y_k) = -s\dfrac{d\bar{y}}{ds}$

$P\{(k+1)\ y_{k+1}\} = -s^2 \dfrac{d\bar{y}}{ds}$ and $P\{(k+2)\ y_{k+2}\} = -s^3 \dfrac{d\bar{y}}{ds} - y_1 s$

Hence if the coefficients in $A(k)\ y_{k+2} + B(k)\ y_{k+1} + C(k)\ y_k = f_k$ are linear functions of k the transformed equation will be a linear differential equation of the first order and first degree. The solution of the equation yields $\bar{y}$ whose inverse can be found from the list.

2. THE DIFFERENTIATION OF LEBESGUE INTEGRALS.

E. J. McShane; *University of Virginia.*

It is well known that if f is Lebesgue integrable, and for each measurable set E we define F(E) to be the integral of f over E, then except on

a set of measure zero F has a derivative and this derivative is equal to f. The usual proof is based on the Vitali covering theorem. In this note it is shown that another proof is possible, based on a lemma simpler than the Vitali covering theorem. The lemma can also be used to furnish a slightly simplified proof of the Vitali theorem.

3. TWO METHODS OF SPINNING ROTORS AT HIGH SPEEDS AND LOW TEMPERATURES.

J. W. Beams; *University of Virginia.*

In the first method the rotor is magnetically suspended inside of two or more concentric dewar flasks. The inner dewar contains liquid helium, and the outer dewar contains liquid nitrogen. The rotor is surrounded by a vacuum tight chamber and is driven by a rotating magnetic field. It accelerates in a way similar to the armature of an induction motor or to that of a synchronous motor.

In the second method the rotor is spun on the end of a long, small diameter, stainless steel hypodermic tube. The rotor is surrounded by a vacuum tight chamber which in turn is surrounded by a dewar flask containing liquid helium. A second dewar containing liquid nitrogen surrounds the inner dewar.

The methods are being used for experiments on the tensile strengths of materials at low temperatures on the properties of super-conducting materials and on the properties of liquid helium II.

4. THE MEASUREMENT OF TENSILE STRENGTH OF METALS AT LOW TEMPERATURE.

John B. Breazeale; *University of Virginia.*

Previous studies of the tensile strength of thin silver films show that for films less than a certain critical thickness the tensile strength increases quite rapidly. A study of the tensile strength of these films is now being made at liquid nitrogen and liquid helium temperatures. The tensile strength of a film is measured by electroplating it on a steel rotor, placing the rotor in an evacuated glass tube which is immersed in liquid nitrogen or liquid helium. The rotor is supported magnetically and spun by a rotating magnetic field until the film is thrown off. If the angular velocity of the rotor when the film is thrown off is known, the tensile strength can be calculated.

Preliminary results at liquid nitrogen temperature indicate that the strength of films much greater than the critical thickness does not differ much from the value found at room temperature. There is, however, some evidence that the value of the critical film thickness at which the tensile strength increases is greater at this temperature than at room temperature.

5. ADSORPTION AND SURFACE ENERGY.

N. Cabrera; *University of Virginia.*

Recently the idea of *negative* surface energy of solids has been used to

explain peculiar effects as, for instance, the growth of tin whiskers.[1] The purpose of this paper is to discuss the conditions under which this idea is correct and to suggest new applications.

First, it is pointed out that the idea is only applicable to the surface of separation of two phases, of a two or more component system, which are *not in equilibrium* with each other. An example could be a metal in the presence of oxygen. It is possible to estimate the pressures at which the surface energy of the metal becomes negative because of the adsorbed layer of oxygen;[2] this pressure should then be related to that at which the system metal-oxygen is not in equilibrium with each other but tends to form a compound. Considering the kinetics of the ensuing chemical reaction, it might be useful to assume a negative surface energy. A treatment along these lines is given for the sharpening of the tungsten point of a field emission microscope when in the presence of oxygen at high temperature.[3]

6. NEUTRON INDUCED SCINTILLATIONS IN PHOSPHORS.

R. Clapp and R. Wagner; *University of Virginia.*

We have investigated the response of various phosphors, both organic and inorganic ,to neutron induced scintillations. NaI (Tl) and LiI (Sn) were the inorganic crystals investigated; benzene, deuterated benzene, and stilbene were the organic phosphors. Information as to the relative fluorescence efficiency of the electron, proton, deuteron, triton, and alpha particle has been obtained with respect to particular phosphors and energies. The experimental arrangement is described and conclusions drawn as to radiations present and the usefulness of the phosphors as neutron detectors is discussed.

7. THE MEASUREMENT OF MOLECULAR WEIGHTS BY THE EQUILIBRIUM ULTRACENTRIFUGE.

J. W. Beams and H. M. Dixon; *University of Virginia.*

In order to determine the molecular weights of substances whose molecular weights vary from one hundred to over one million, a sedimentation equilibrium ultracentrifuge has been developed which employs a magnetically supported steel rotor that is permitted to coast freely at a speed of several hundred revolutions per second in an evacuated and thermostatted chamber. The concentration of the solution in the centrifuge cell is determined with the aid of a modified Jamin interferometer, the necessary synchronized stroboscopic illumination of the interferometer being produced by the use of a slit in the rotor to admit light from a continuous source onto the interferometer at the desired moment.[4] The weight average molecular weight of a substance of several species contained in a very dilute ideal solution is given by the equation

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[1] F. C. Frank, Phil. Mag. 44, 854 (1953).
[2] C. Herring, p. 41 in **Structure & Properties of Solid Surfaces,** Chicago 1953; ed. by R. Gomer and C. S. Smith.
[3] E. W. Muller, Zeit. f. Phys. 108, 668 (1938); Erg. exak. Naturwis. 27, 290 (1953).

$$M\omega = \frac{2\pi\lambda RT}{(1 - \bar{v}\rho)\omega^2 \alpha(\mu - \mu_0)(\gamma_b^2 - \gamma_a^2)}$$

where π is the total fringe shift of light with wavelength λ in the interferometer. R is the molar gas constant and T is the temperature of the rotor whose angular speed is ω. $(1 - \bar{v}\rho)$ is the buoyancy correction for the material in solution, μ is the index of refraction of the initial solution and μ_0 is the index of refraction of the solvent. The thickness of the centrifuge cell is α, the radii from the axis of rotation to the inner and peripheral walls of the cell are respectively γ_a and γ_b.

8. THE EFFECT OF A CENTRIFUGAL FIELD ON DIFFUSION IN METALS.
Orville R. Harris; *University of Virginia.*

9. POSITRON ANNIHILATION IN LIQUID HELIUM.
Frank L. Hereford; *University of Virginia.*

Positrons in matter are known to capture electrons to form either singlet or triplet state positronium atoms (anti-parallel or parallel spins, respectively).[5] Singlet positronium subsequently annihilates in about 10^{-10} sec. with emission of two photons; triplet positronium annihilates in about 10^{-7} sec. with emission of three photons. Actually most triplet positronium in solids is converted to the singlet state in a time much less than 10^{-7} sec. by means of collision induced electron exchange; hence, the ratio of 3-photon annihilations to 2-photon annihilations in solids is small (less than 1%). In most gases, however, the reduced electron density enables the triplet state to persist long enough for an appreciable number of 3-photon annihilations to occur. This simple explanation, however, fails to account for several anomalies in existing data.[6] In a further attempt to clarify this situation, we have compared the ratio of 3-photon to 2-photon annihilations for positrons stopping in liquid helium to that for positrons in aluminum. It seemed possible that the smaller electron density and smaller frequency of thermal collisions in liquid helium might enable the triplet state to persist longer. This would result in a greater 3-photon to 2-photon ratio in liquid helium relative to that in aluminum. The experimental data, however, indicate no difference in the ratio. Apparently the electron density in liquid helium is sufficient to destroy triplet positronium in a time much less than 10^{-7} sec.

10. THE MAGNETIC BALANCE.
Charles W. Hulburt; *University of Virginia.*

The magnetic balance was originated after Dr. Beams [7] noted that a small magnetically supported rotor dropped in position when the gas surrounding it was removed. This effect was attributed to the change in

[4] Beams, et al, Rev. Scientific Instruments, 25, 295, (1954)
[5] M. Deutsch, Phys. Rev. 82, 455 (1951).
[6] Bell and Graham, Phys. Rev. 90, 644 (1953).

buoyancy. By visual observation, it was estimated that mass changes of 10^{-9} gram could be detected.

While investigating this effect, Dr. Lotz[8] noted changes of 10^{-7} gram and estimated that changes of 5×10^{-9} gram could be detected.

The system used at present is the same as that used by Lotz.[8] The noise level has been reduced by a factor of four. The sensitivity has been increased so that effective changes of mass of 10^{-9} gram have been observed when a sphere, 0.2 mm. in diameter is supported.

While working with nitrogen to calibrate the instrument, it was found that the sphere ceases to exhibit the buoyancy effect in the region about one mm. Hg or in some cases above. At pressures below this critical pressure, the sphere exhibits an effective decrease of mass, of a magnitude greater than the buoyancy effect. This indicates that the adsorbed gas, on iron or ferrite crystal, amounts to a greater total volume at NTP than the amount displaced at atmospheric pressure.

11. LATTICE SUMMATIONS IN CRYSTALS AND ENERGY OF TWIN BOUNDARIES.

Melvin M. Levine; *University of Virginia.*

By assuming Lennard-Jones potential interactions between the pairs of atoms it is possible to calculate the energy differences between various stacking orders of a close-packed layered lattice. These energy differences are quite small, the difference between hexagonal stacking (the lowest in energy) and face centered cubic (the highest) being of the order of .01%, with the intermediate polytypes being closer in energy.

This suggests the possibility that the different polytypes may be nearly equally stable energy-wise (although this treatment neglects the entropy contribution to the free energy) so that the appearance or non-appearance of the various structures may be attributed to differences in growth rates.

The calculations are done by considered the energy of an atom in the structure with respect to the various planes, applying a Fourier development (along the lines of that by Hove and Krumhansl in Physical Review 92, 3 (1945)).

12. DISPERSION OF THIN LAMINA.

H. Y. Loh; *Virginia Polytechnic Institute.*

Optical dispersion of thin lamina has been determined by means of channelled spectrum. By this method, samples of uniform thickness of a few square millimeters area are coated with highly reflecting metal film, and then the transmitted, channelled spectrum is taken at normal incidence with a calibrated prism or grating spectrograph. With one spectrum, many fringes can be obtained and the indices of refraction at these wave-lengths can be calculated.

This method requires one value of index of refraction at a known wavelength; that can easily be measured with a standard refractometer. It

[7] Beams, J. W., Rev. Sci. Instr. 21, 182 (1950).
[8] Lotz, W. E., Magnetic Balance Dissertation in Physics, Univ. of Va. (1953).

is applicable to laminae of crystal or other optical material with a thickness of about twenty microns or less. The wave-length range extends well over the visible region if a proper continuous light source is available.

The channelled spectrum of muscovite taken with a grating spectrograph and the dispersion curves of two polarized components, covering from 3300 to 6600A are shown. The accuracy of the method and the phase shift due to the metal film are discussed.

13. ANGULAR DISTRIBUTION OF PHOTOELECTRONS PRODUCED BY 0.4 TO 0.8 MEV POLARIZED PHOTONS.

William H. McMaster; *University of Virginia.*

The angular distribution of high energy (0.4 – 0.8 Mev) photoelectrons produced in Pb and Au foils by linearly polarized photons has been investigated using scintillation counting and pulse height analysis techniques. A Compton scattered photon beam from Co^{60} provided a source of partially polarized radiation. The cross section for the distribution of K-shell photoelectrons was first calculated by Sauter [9] using Dirac's relativistic wave equation. The cross section is of the form

$$d = A + B \cos^2 \phi.$$

In the non-relativistic limit the second term predominates in agreement with non-relativistic calculations. For high energies (0.5 Mev), the first term, containing the square of the energy, predominates,[10] and the second term becomes negative resulting in photo-emission predominately orthogonal to the electric vector of the incident photon. Experimental results confirm this phenomenon and are in good agreement with the distribution predicted by Sauter.

14. AN INEXPENSIVE DEVICE FOR MEASURING X-RAY POWDER DIFFRACTION PATTERNS.

W. Richardson; *Virginia Polytechnic Institute.*

An easily made device for holding and measuring the line-spacing on powder diffraction pattern is described. Measurements are made with a vernier to 0.1 mm. The design of the instrument makes it convenient and easy to use. The major cost was $4.00 for the steel scale used.

15. AN X-RAY DIFFRACTION MACHINE ASSEMBLED ALMOST ENTIRELY FROM WAR SURPLUS PARTS.

James Scott, R. K. Brown, and W. Richardson; *Virginia Polytechnic Institute.*

As an example of the use of war surplus parts in constructing valuable equipment for use in college laboratories, the design and construction of a half wave x-ray diffraction machine is described. The cost of new

[9] F. Sauter, Ann. d. Physik 11, 454 (1931).
[10] F. L. Hereford and J. P. Keuper, Phys. Rev. 90, 1043 (1953).

material used was estimated to be less than twenty-five dollars, less x-ray and rectifier tube. Commercial machines of comparative performance are priced at around $3,000.00.

16. MECHANICAL STRENGTH OF THIN FILMS OF METALS.
Edward F. Turner, Jr.; *University of Virginia.*

The tensile strength of thin silver films has been investigated as a function of film thickness, using the techniques of Beams and others.[11, 12, 13] Silver is electroplated on cylindrical steel rotors which are then magnetically suspended and spun in a vacuum. Adhesion of the silver films to the steel rotors in reduced by subjecting the plated rotors to alternate hot and cold baths with a 180 degree centigrade temperature range. In the absence of adhesion, the tensile strength is calculated from the equation $T = \rho \omega^2 R^2$, where ρ is the density of silver, R the radius of the rotor, and ω the angular speed at which rupture of the film occurs. Results of this investigation indicate the tensile strength does not exhibit the discontinuous increase reported earlier, but increases uniformly, beginning at thicknesses of the order of 10 centimeters. The shape of the curve is compared with theoretical predictions based on the Frank-Read scheme of anchored dislocations.[14]

17. COMMENTARY ON LOCATING AND CONSTRUCTING THE IMAGE OF A VIRTUAL OBJECT.
H. D. Ussery; *Virginia Polytechnic Institute.*

When in a train of several lenses, the image as formed by one element falls beyond the next element, this image is designated as the virtual object for the second lens.

The conventional construction for thin lenses requires the tracing of at least two principal rays from an object point through each element into the corresponding point in the final image.

In the not so conventional construction described in this paper, it is shown that the correct results may be obtained by reversing the sign of the second lens and considering the virtual object as a real object for the second lens. This necessitates two sign changes in the lens formula.

18. THE MEASUREMENT OF GYROMAGNETIC RATIOS BY A NEW METHOD.
Glen S. Waterman; *University of Virginia.*

At last year's meeting of the Virginia Academy a new method of measuring the gyromagnetic ratio in ferromagnetic materials by use of the magnetic suspension was described. The current experiments are an extension of the foregoing. Three, instead of two, coils are used, the upper coil being divided into an inner and outer winding of approximately the same number of turns. The lower coil is still a single winding. The rotor is

[11] T. J. Turner, Dissertation, University of Virginia (1951).
[12] W. E. Walker, Dissertation, University of Virginia (1952).
[13] H. S. Morton, Dissertation, University of Virginia (1953).
[14] F. C. Frank & W. T. Read, Physical Review 79, 722, (1950).

now supported and controlled only by the action of the inner winding of the upper coil. Variation of field intensity, hence, magnetic moment in the sample, is achieved through activating the outer winding of the upper coil and the entire lower coil independently. The advantages of this method are that the controlling current and the electronic control circuit need not be touched during the process of changing the field intensity, and as a result, more stability is attained. Further, the increased sensitivity and efficiency of control has permitted changing from a rotor of .73 mm. diameter with a rotating time of approximately 36 minutes to one of only .35 mm. diameter which can be turned at a rate equivalent to a period of only nine minutes. Due to magnetic coupling with the earth's field, at the present time it has not been possible to start with zero angular momentum and to cause it to rotate at the slow speed equivalent to a period of nine minutes. As a result, it has been necessary to start with a small initial rotation of approximately 16 rev. per min. and to measure the change in this due to the gyromagnetic effect.

19. THE VISUAL ORBIT OF MU ORIONIS.

Harold L. Alden; *Leander McCormick Observatory, University of Virginia.*

The star Mu Orionis is a triple system which presents some puzzling features. The brighter star is a spectroscopic binary with a period of 4.4 days and is the primary of a visual double with a period of 18.25 years. The relative visual orbit has been derived from observations by eight different observers on 80 nights since 1914. Assuming certain elements from spectroscopic data, the semi-major axis is found to be 0."254 and the inclination 98°. The computed dynamical parallax is 0."019, about 2/3 the weighted mean of five separate trigonometric determinations. Alternatively, using the trigonometric parallax, the mass of the system becomes 2.24 solar masses. This is about the mass to be expected for the primary alone. Furthermore the astrometric data obtained by Dr. Osvalds indicates that the visual companion possesses about 40 percent of the total mass of the system although it is only 1/10 as luminous as the primary. This is at variance with our accepted ideas of the relation between mass and luminosity.

20. PHOTOMETRY OF RED DWARFS.

George S. Mumford, III; *University of Virginia.*

In 1941 Vyssotsky began, at the Leander McCormick Observatory, a systematic survey of objective prism plates to discover red dwarf stars (spectral type dK8 to dM5). Since September 1953, the magnitudes and colors of 97 of these stars have been observed with the photoelectric photometer attached to the 26-inch visual refractor of the Leander McCormick Observatory. First results show that the average color of a dK8 star is +1.22 mags.; of a dM0, +1.38 mags.; of a dm2, +1.47 mags.; and of a dM5, +1.56 mags. The shift to the red in color for later spectral types is expected.

A color-luminosity diagram was drawn up for 25 of these stars whose parallaxes were known. Except for the bright stars, this diagram is similar to the red end of the standard ones of this type.

21. THE UNUSUAL VARIABLE STAR EZ AQUILAE.

Charles P. Oliver; *Flower and Cook Observatories, University of Pennsylvania.*

22. THE ASTROMETRIC ORBIT AND MASS-RATIO OF MU ORIONIS.

V. Osvalds; *Leander McCormick Observatory.*

Sufficient material for the astrometric orbit of this triple system has been collected at two observatories: Yale University Southern Station and McCormick. At the first one 59 plates have been taken with the photographic 26″ refractor during the years 1928-47 covering slightly more than one period. One hundred and three plates have been taken with the 26″ McCormick visual refractor during the years 1923-26, 1930-37, and 1946-53.

Measured and reduced, this material gives the following results:

Solution	*a*	*i*	*B*
McCormick	0″.080	97°.8	0.41
Yale	.113	84.8	.46
Combined	.089	91.8	.43

a = semi-axis major; i = inclination; B = mass-ratio, companion to the total mass of system.

The first two solutions show a certain discrepancy which, at least partially, is a result of using different types of telescopes. For the same reason the combined solution should be taken without confidence since different type of measure have been combined.

In the last column are the mass-ratio-ratios obtained using a = 0″.254 from visual orbit, derived by Professor Alden. The mean agrees with the mean obtained by him in 1944 using the material from the same observatories.

23. A BIBLIOGRAPHY OF LOGARITHMIC SPIRALS.

Georgie T. Davis and D. S. Davis; *Virginia Polytechnic Institute.*

A bibliography of spirals is presented under the headings of history of spirals, properties of spirals, spirals in nature, and miscellaneous uses of spirals.

24. SOME RELATIONSHIPS CONCERNING NEO-PYTHAGOREAN TRIANGLES.

Herta Taussig Freitag and Arthur H. Freitag; *Hollins College and Jefferson Senior High School, Roanoke.*

In Euclidean plane geometry of the complex domain, Neo-Pythagorean Triangles are defined as those triangles whose sides obey the condition that the sum of their squares vanishes.

Many relationships pertaining to Neo-Pythagorean Triangles are shown. Most of the theorems have valid converses of the form that, if the condition under discussion holds, then the triangle is either Neo-Pythagorean or degenerate. In some cases the triangle is either Neo-Pythagorean or else equilateral. No claim of completeness is made in the set of relationships developed.

The theorems state interdependencies of angles of Neo-Pythagorean Triangles, of sides, or sides and angles. There are formulas for area, circum-radius, in-radius, lengths of medians, and angle-bisectors.

The following examples illustrate the types of theorems found: In Neo-Pythagorean Triangles (1) the sum of the cotangent values of the angles vanishes; (2) the sum of the sixth powers of the sides equals three times the product of their squares; and (3) the cosines of the angles are proportional to the cubes of the corresponding medians.

The proofs of these theorems are based on the ordinary laws of trigonometry or of analytic geometry.

25. A BRIEF METHOD FOR TRANSFORMING RECURRING DECIMAL FRACTIONS TO COMMON FRACTIONS.

Herta Taussig Freitag and Arthur H. Freitag; *Hollins College and Jefferson Senior High School, Roanoke.*

The rational character of a non-terminating decimal-fraction is recognized by the occurrence of repeating decimal digits. Such decimal-fractions can be transformed into common fractions by the following method.

The whole number part of the resulting mixed number is the integral part of the given decimal.

The denominator of the fractional part of the mixed number has as many nines as there are digits in the "period" (repeating part) of the decimal. These nines must be followed by as many zeros as there are digits in the number's "ante-period" (digit or group of digits preceding the period). If the number does not contain an ante-period, no zeros will appear.

The numerator is the number obtained by subtracting the ante-period from the number written by reading the fractional part of the given decimal up to and including the first period. The numerator consists of the period alone if the number has no ante-period.

The proof of this method consists in expressing the given repeating decimal algebraically, using the summation formula of an infinite geometric progression for which $|r| < 1$, and performing certain simplifications.

26. IONIZATION IN FLAMES.

I. R. King and H. F. Calcote; *Experiment Incorporated, Richmond.*

27. A SET OF LECTURE DEMONSTRATIONS.

L. G. Hoxton; *University of Virginia.*

Shown for the first time, although some of the method shave been previously described (indicated by the year in parentheses) before the Section.

1. *Foucault Pendulum* (1933). The paths of the vertically projected image of a marker on the suspending wire swept out an angle of 4° in 26 min. as predicted by computation.

2. *Speed of Rifle Bullet.* Directly measured by shooting through two cardboard disks two meters apart on a shaft driven by a synchronous motor at 1800 rpm. Result 320 m/sec. (22 short ammunition).

3. *Falling Target* electromagnically released 30 ft. from air gun and 22 ft. above table. Particular interest: large scale and use of lamp bulbs for targets. Gun (1928) aimed with light beam.

4. *"Relativity Car"* on Incline mounted a spring gun aimed upward perpendicular to the track. A steel ball would fall back to muzzle when the car was running freely in any manner on an incline as well as on the level.

5. *Complementary Colors with Polarized Light.* A doubly refracting prism was substituted for the "analyzer" in the usual arrangement. The two colored images projected on the screen could be made to separate or overlap by moving the prism along the optic axis. The overlap was white.

6. *Double Pendulum.* A light pendulum suspended from the bob of one much heavier was driven electrically. Invariably, after starting, the motion would settle down to one of its normal modes, the other dying out. The permanent mode could be predetermined by adjusting the relative lengths of the pendulums.

7. *Drinking Bird* viewed as a thermodynamic engine illustrating the second law by stopping when covered by a glass jar.

8. A few items such as an early form of the Beams high speed rotor, ripple tank, large scale Lenz law apparatus, and the curious fact that a piece of "BX" cable armor, when moistened, becomes a whistle. (First two items shown previously.)

MINUTES OF THE BACTERIOLOGY SECTION [3]

P. ARNE HANSEN, *President*
H. J. WELSHIMER, *Vice-President*
W. F. LAWRENCE, *Secretary-Treasurer*
J. DOUGLAS REID, *Section Editor* (1956)

SATURDAY, MAY 8—11:00 A.M.—ROOM C3—UNIVERSITY OF VIRGINIA—SCHOOL OF MEDICINE

1. THE FERMENTATION OF GLUCONATE BY *Propionibacterium pentosaceum* AND ITS POSSIBLE ROLE AS AN INTERMEDIATE IN GLUCOSE METABOLISM.

Wesley A. Volk; *School of Medicine, University of Virginia.*

The operation of a typical Embden-Meyerhof pathway in the propionic acid bacteria has been suggested, but a clear demonstration of this is still lacking. Wood and Leaver (Fed. Proc. *11*, 313, 1952) reported using glucose–1–C^{14} and glucose 3,4–C^{14} that the distribution of the tracer could not be accounted for on the basis of the Embden-Meyerhof scheme.

The present report presents data which suggest that there is a C_1 and C_5 split of hexose in addition to the presence of the Embden Meyerhof pathway. Using cell free extracts of *Propionibacterium pentosaceum* strain E214 a check revealed the presence of the following enzymes of the Embden-Meyerhof scheme: hexokinase, phosphohexoseisomerase, phosphofructokinase, aldolase, and enolase. Radioactive techniques have resulted in data indicating that perhaps two different pathways are being utilized simultaneously. When glucose–1–C^{14} was fermented 15% of the tracer was found in the metabolic CO_2. Since this indicated a shunt mechanism, gluconate–1–C^{14} was fermented and in this case 100% of the tracer was found in the CO_2.

Work is being continued using cell free extracts in an attempt to demonstrate the enzymes responsible for the dissimilation of glucose.

2. COMPARATIVE BACTERICIDAL EFFECTS OF MOIST AND DRY HEAT ON CERTAIN NONSPOROGENOUS BACTERIA.

H. T. Knighton; *Medical College of Virginia.*

Small sterile metal instruments (files used for treating root canals of teeth) were contaminated with 18 to 20 hour brain heart infusion broth cultures of micrococci, streptococci, or gram-negative nonsporing rods. The contaminated instruments were dried for 6 hours at 37° C. and subjected to hot oil (100° to 150° C.) and 100° C. water for varying periods of time. After desired periods of heating, each object was placed in a 10 ml. lot of broth medium and cultured at 37° C. for seven days.

Results indicated: (a) time required for bactericidal effects decreased approximately twofold for each 10° C. rise in temperature of hot oil between 100° C. to 150° C., and (b) 150° C. hot oil was necessary to equal 100° C. water in rapidity of killing all bacteria tested.

3. AN EXAMPLE OF A MULTISPOROGENOUS BACTERIUM.
H. J. Welshimer; *Medical College of Virginia.*

Slides are presented showing *Metabacterium polyspora* containing 2 to 8 spores per organism.

4. RESPIRATION OF *Mycobacterium paratuberculosis.*
Robert H. Miller and P. Arne Hansen; *University of Maryland, College Park, Maryland.*

Respiratory studies were carried out with three strains of *M. paratuberculosis* suspended by means of the surface active agent Triton A-20 in phosphate buffer at pH 6.4.

The low rate of respiration of this species (Qo_2 — about 7) in atmospheric air with lactate as substrate may be increased by using higher oxygen tension; however, the respiration even in 100 per cent oxygen, which gave the maximum rate, was only 32 per cent above the rate at 20 per cent oxygen.

Dextro and levo lactic acids are respired at approximately the same rate and the respiration is completely inhibited by M/500 HCN in both instances. There seems to be a slight recovery in case of the dextro lactate. The concentration of HCN was quantitatively controlled in the gas phase by virtue of a $Ca(CN)_2 - Ca(OH)_2$ center well mixture.

Nydrazid (M/80) and neomycin (16 units/ml.) inhibit the respiration temporarily.

It is emphasized that in order to obtain valid results, cell suspensions must be used in which proportionality will exist between amount of cells and oxygen uptake. This was true for cell suspensions in the range of 2-3 mg. cells per ml.

Respiration does not appear too sensitive to pH changes in the interval 6.4 — 7.0.

5. THE TUBERCULOSIS PROPERTIES OF ASCORBIC ACID.
Quentin N. Myrvik and Wesley A. Volk; *School of Medicine, University of Virginia.*

Ascorbic acid has been shown to be inhibitory for several species of microorganisms including the pathogenic mycobacteria. Several theories have been proposed to explain the mechanism of inhibition but all of them are unsatisfactory.

In the present investigation the possible role of the ene-diol group was investigated by determining the antibacterial spectra of ascorbic acid and the following substances (shown by paper chromatography to give rise to compounds containing ene-diol groups): diacetyl, acetoin, inosose, and

dihydroxyacetone. All gave similar antibacterial spectra when tested against *Escherichia coli, Mycobacterium phlei, Pseudomonas* sp. and the BCG, H37Rv, and Ravenel strains of *M. tuberculosis.* In a series of short term experiments it was observed that diacetyl immediately inhibited growth, whereas fresh ascorbic acid failed to do so. These results suggested that the diketone (oxidized ene-diol) might be responsible for the inhibition rather than the ene-diol group. Experiments with other adjacent diketones support this hypothesis.

Chromatographic studies of autooxidized ascorbic acid in this laboratory have revealed two additional compounds with ene-diol characteristics. It is proposed that these as yet unidentified "reductones" arising from ascorbic acid are oxidized to diketones over an extended period and account for the antibacterial properties of autooxidized ascorbic acid.

6. SOME ENVIRONMENTAL FACTORS IN THE CULTIVATION OF *Endamoeba histolytica.*

E. Clifford Nelson and Muriel M. Jones; *Medical College of Virginia.*

Rice flour is an adequate nutrient for *Endamoeba histolytica* grown in a medium composed of an agar slant containing dibasic magnesium phosphate overlaid with phosphate buffered saline. The role of the magnesium phosphate appears to be a solid particle effect such as that noted by Bigger. Alundum, sea sand, and talc are equally effective. Efforts to demonstrate diffusion of an ameba growth promoting substance from rice flour were not successful.

7. ELECTROPHORETIC BEHAVIOR OF *Salmonella pullorum.*

Shelley Harrell and P. Arne Hansen; *University of Maryland, College Park, Maryland.*

The electrophoretic mobility has been determined for several strains of *Salmonella pullorum* using cultures which by serological tests had been classified as "standard", "variant", and "intermediate". The isoelectric point was found to be different for the three varieties. Working at pH 5.08 (acetate/barbital buffer) with a modified Brigg's microelectrophoresis cell, these forms could be differentiated by their rate of migration. Only "standard" strains moved toward the anode. "Variant" moved toward the cathode and at a faster rate than "intermediate" strains. As old cultures may show a very irregular behavior a number of frequent transfers is essential in order to obtain constant results.

8. THE GROWTH OF EHRLICH ASCITES CARCINOMA CELLS IN THE SUCKLING RAT.

Michael Potter; *School of Medicine, University of Virginia.*

Ehrlich Ascibes Carcinoma cells grown in the mouse and inoculated intraperitoneally in suckling rats of 8 to 24 days of age were found to proliferate rapidly. When a certain minimal number of cells is inocu-

lated death of the animal results in a high percentage of cases. The cause of death appears to be due to peritoneal hemorrhage and pulmonary infiltration by the tumor. Viable tumor cells can be isolated from the lungs of these rats. These cells of rat lung origin readily reproduce the typical ascites tumor in mice.

9. SOME EXPERIMENTS WITH THE MOLECULAR FILTER MEMBRANE TECHNIQUE AND DEMONSTRATION OF THE APPARATUS.
R. Travis Hill; *Virginia State Department of Health, Richmond.*

10. DEVELOPMENT, USE, AND EFFECTIVENESS OF B. C. G. VACCINE.
William F. Wagner; *Virginia State Department of Health, Richmond.*

MINUTES OF THE SECTION OF BIOLOGY [4]

ZOE WELLS CARROLL BLACK, *Chairman*
VERA B. RAMSBURG, *Vice-Chairman*
KENNETH P. STEVENS, *Secretary*
ROBERT T. BRUMFIELD, *Section Editor* (1957)

FRIDAY, MAY 7, 1954—9:00 A.M.—MAURY HALL

1. NOTES OF NUTRITION IN *Arcella discoides.*

John E. Davis, Jr.; *University of Virginia.*

Penicillin, dihydrostreptomycin, and aureomycin were added, both singly and in combinations, to clone cultures of *Arcella discoides* in attempts to obtain bacteria-free cultures. Pure (bacteria-free) cultures were obtained by the use of penicillin (1200-2000 units/ml.), dihydrostreptomycin (100 mg./ml.), and aureomycin (25 mg./ml.) singly, and penicillin in combination with either of the latter two. Combinations containing both aureomycin and dihydrostreptomycin resulted in a clouding of the cultures which rendered them useless. Contraction of cytoplasm and lack of division occurred in the absence of bacteria. This adds to the evidence for the necessity of bacterial flora or the metabolic products of bacteria for normal growth in *Arcella discoides.*

2. MORPHOLOGICAL OBSERVATIONS ON *Cambarincola Sp., Oligochaeta, Branchiobdellidae.*

Benjamin Irving Johns; *University of Virginia.*

Since the published keys to the genus *Cambarincola* cannot be used to separate the many and varied forms found in the southeast, this morphological survey of a new species should be of taxonomic value. The emphasis has been placed on describing each system separately, and charts have been made to show the comparative differences of the members of the Subgenus *Coronata* already studied. This species of branchiobdellids has only been reported from the crayfish, *Cambarus sciotensis,* in Sinking Creek, Giles County, Virginia. The new species differs from other species of the subgenus in dental formula, body size, and shape of the copulatory bursa.

3. STAIN TECHNIQUE AND OBSERVATIONS FROM A PRELIMINARY STUDY OF MEGAGAMETEGENESIS IN *Ilex opaca.*

J. M. Herr, Jr., *Washington and Lee University.*

The safranine-fast green staining procedure described by Johansen (1940) and widely used in the study of megagametogenesis in Angiosperms is not entirely suitable for such a study in *Ilex opaca.* Safranine specifical-

ly stains lignified structures and some nuclear material; fast green is confined to the cytoplasm. Inadequate staining, therefore, results in the failure of these stains to affect cellulose cell walls, cell membranes, and nuclear membranes. Unstained, these structures are rarely visible in normal illumination, and they transmit light sufficiently to reduce the visibility of nearby stained structures. Adequate staining, however, is achieved when sections are first placed in a ferric ammonium sulphate mordant for ½ hour, stained in a mixture of alcoholic hematoxylin and safranine for 24 hours, and finally are counterstained with fast green. The preparation of the mordant and the individual stains and the procedure for counterstaining is carried out as recommended by Johansen (1940). Use of a combination of 1 to 1.25 milliliters of alcoholic hematoxylin to 60 milliliters of safranine yields the most suitable results. Sections often appear very dark if the hematoxylin content exceeds 2 milliliters. Megagametogenesis in *Ilex opaca* follows the Polygonum-type with variation in regard to position of the functional megaspore and behavior of the antipodal cells.

4. THE LOCALIZATION OF CHIASMATA IN THE X-BIVALENT OF THE GOLDEN HAMSTER.

Charles I. Sheaffer; *University of Virginia.*

The x-chromosome of the golden hamster at meiosis in the male consists of a deeply staining pairing segment and a more lightly staining slender, elongate differential segment. At the spermatogonial divisions the entire x-chromosome is contracted and stains uniformly. The differential segment represents approximately 7 percent of the x-chromosome and is indistinguishable from the pairing segment. In the female hamster the two x-chromosomes are uniformly contracted and the differential segment indistinguishable as in the spermatogonial mitosis. Chiasmata at meiosis are formed only between short arms of the x-chromosomes and hence are localized in those arms which are partly made up of the differential segment. The arm of the x, which in its entirety has no counterpart in the y and consequently cannot undergo crossing over in the male, is the arm in which chiasmata are localized in the female.

5. COMPARISON OF CERTAIN DEVELOPMENTAL FEATURES OF FIBER FOLLICLES OF SHEEP AND GOATS.

Lubow A. Margolena; *Agricultural Research Service, United States Department of Agriculture.*

A comparative study of dorsal and ventral fetal skins of 21 Karakul sheep and 19 goats was made. The age of the foetuses ranged from about six to 21 weeks. The follicular anlagen may appear from a unilayered epidermis upward of two months. In differentiated skins of both animals the epidermis proper is about three layers thick. The two generations of follicles that develop are essentially distinguished from one another by the same characteristics, namely, the primary ones develop accessory structures, while the secondary fail to do so. The topographic relation between the primary and secondary follicles is analogous in both animals.

The hardening of the inner root sheath and the development and keratinization of the primary fibers take place at approximately the time that elastic fibers make their first appearance. The hair canal is constructed from a differentiated region in the epidermis, a region formerly occupied by anlagal cells, and present much before the sebaceous gland. Epidermal melanoblasts play a special heralding role in relation to follicular anlagen of goats and sheep. Their appearance, distribution and the eventual pigmentation of the fibers are discussed. The blood supply in the skin is more abundant in goats than in sheep; capillaries are much more conspicuous in the follicular papillae of goats than in those of sheep.

6. CHROMOSOMES OF REPRESENTATIVES OF ALISMATACEAE IN GRAY'S MANUAL RANGE.

J. T. Baldwin, Jr. and Bernice M. Speese; *College of William and Mary.*

The Alismataceae are represented in the range of Gray's Manual by *Alisma* with three species, by *Echinodorus* with three species and one form, by *Lophotocarpus* with two species and three forms, by *Sagittaria* with sixteen species and eleven varieties and forms. Nineteen of the twenty-four species and nine of the fifteen intraspecific taxa have been cytologically investigated. Representatives of *Alisma* have 2*n*-numbers of 14 and 28; the other plants, 2*n* of 22. The four genera are separable on the basis of idiograms. Chromosomal evidence indicates that *Lophotocarpus* should not be merged with *Sagittaria*, as is sometimes done. The idiogram for *Sagittaria* is remarkably uniform from one species to another. *Sagittaria* chromosomes react differently to colchicine and to paradichlorobenzene: the authors have not observed this difference in plants of dozens of other genera that have been studied.

7. A STUDY OF NORMAL AND ABERRANT MEIOSIS IN OOCYTES OF THE NEWT, *Triturus viridescens.*

Asa A. Humphries, Jr., *University of Virginia Medical School.*

Study of meiosis in sections of 329 oocytes from the ovaries, coelom, and oviducts showed the meiotic process to be essentially similar to that described in most other amphibia. Ovulation ordinarily occurs shortly after the formation of the first meiotic spindle. Coelomic eggs, unless retarded in transit, are generally in metaphase I. The first polar body is most often formed while the oocyte is in the anterior one-third of the oviduct. Very few stages earlier than metaphase II were found in the posterior one-third of the oviducts. Submerged and/or tangential first and second meiotic divisions were observed, as were virgin eggs in the second division showing the diploid number of dyads and virgin eggs showing two separate haploid groups of chromosomes in the second division. These aberrant conditions provide an explanation for the occurrence of spontaneous polyploids and chromosome mosaics, and for certain diploid parthenogenetic embryos. Coelomic and oviducal eggs may be transferred from donor animals into foster mothers for fertilization. Such

eggs generally develop normally. The usual time required for passage of an egg through the oviduct seems to be about twenty hours. The shortest time elapsed was sixteen and one-half hours.

8. ECOLOGY OF THE RED CEDAR, *Juniperus virginiana*.

A. B. Massey; *Virginia Polytechnic Institute*.

Juniperus virginiana, red cedar, is generally scattered over the State. In the Valley of Virginia where the soil is thin over dolomitic limestone or where dolomite outcrops, juniper is commonly the pioneer arborescent species in abandoned clearings, forming juniper communities. In the Piedmont, juniper communities develop in association with dibasic rock. In the Coastal Plain, the development of juniper communities is associated with accumulation of shells in the soil. Circumstantial evidence indicates that some base in the soil promotes the development of juniper. The question arises, from circumstantial evidence, is the base magnesium?

9. NOTES ON THE EVOLUTION OF THE LONGULUS GROUP OF THE CRAYFISH GENUS *Cambarus*.

Horton H. Hobbs, Jr., *University of Virginia*.

Five members of the genus *Cambarus* inhabiting tributaries of the Tennessee, James, Roanoke, Yadkin, and Kanawha rievrs in Tennessee, North Carolina, Virginia, and West Virginia constitute the Longulus Group. It is postulated that these crayfishes have a common ancestry with the members of the Extraneus Group, and that their progenitors migrated northeastward and westward from the southwestern foothills of the Blue Ridge and Smoky Mountains up the Tennessee Valley, into the New River System in Virginia, and finally into the James River. Since the ranges of the five species do not overlap it is obvious that geographic isolation alone would suffice to explain the divergence which has occurred in the primitive stock. In the absence of data from the fields of genetics, cytology, and serology no other isolatory mechanisms are postulated.

10. SULFUR NUTRITION AND THE AMINO ACID COMPOSITION OF FUR IN RELATION TO THE FUR-CHEWING SYNDROME IN DOMESTIC CHINCHILLAS.

C. O. Watlington, J. P. Baker, and K. W. King; *Virginia Polytechnic Institute*.

The cause of fur-chewing, a bizarre behavior common among domestic chinchillas, has been investigated from two approaches, (1) supplementation of the diet with Na_2SO_3, methionine, and cystine and (2) analysis of the amino acid constituents of the fur. Data from a preliminary four-month feeding experiment using 21 animals whose rations were fortified with sulfur are presented. Qualitative paper chromatographic data on the amino acid composition of the fur and quantitative analyses using ion exchange chromatography comparing the amino acid composition of normal and fur-chewed pelts are presented.

11. PHYSIOLOGY OF DIAPAUSE IN THE GRASSHOPPER EMBRYO, STUDIED BY A NEW METHOD OF IN VITRO CULTURE FOR INSECT EMBRYOS.

Donald H. Bucklin; *The College of William and Mary.*

Embryos of the grasshopper *Melanoplus differentialis* have been removed from the egg and cultured *in vitro* from early stages to the stage of hatching, using a new method. The technique has been applied to several problems, including experimental analysis of compound eye development and of embryonic diapause. Embryos in a state of developmental arrest (diapause) were explanted to hanging drops of Ringer solution. Diapause was promptly terminated. Development resumed and proceeded at the normal rate to the stage of hatching. In addition to terminating a pre-existing diapause, this treatment prevented an incipient diapause, in explanted pre-diapause embryos. In an effort to explain this growth-stimulating effect, two factors have been manipulated, namely, the composition of the culture medium and the condition of the explanted embryo. The fact that diapause embryos resume development in a wide variety of media, including non-electrolytes, suggests that we are not dealing with stimulation of some dormant physiological system by specific ions. The fact that yolk-free fragments of diapause embryos resume development on explantation, suggests that the treatment does not act by stimulating the yolk cells or by activating an endocrine organ, as has been proposed by some authors.

12. THE SODIUM AND POTASSIUM ION CHANGE IN THE BLOOD OF HIBERNATING HAMSTERS.

Lucy Byrd Pegau; *University of Virginia.*

The process of hibernation is believed to be dependent upon the ability of certain homeothermic animals to undergo profound physiological changes. If such drastic changes do occur, the question was raised as to whether the sodium and potassium ion concentrations in the blood of animals would not undergo a marked change during hibernation since the normal concentrations of these ions are so intimately associated with the well-being of the living cell. Syrian hamsters were found to hibernate readily at temperatures of from 4° C. to 8° C. Blood was removed for analysis by cardiac puncture from these and from normal, awake animals. Flame photometric analyses were made on the blood of hamsters to determine the sodium and potassium ion concentration in the blood of hibernating and awake animals. The ion concentration readings from these blood analyses showed: 1. a control range for potassium from 3.7 m. eq. to 6.5 m. eq., with a mean value of 5.0 m. eq., per 100 cc. of blood; 2. an experimental range for potassium from 3.6 m. eq. to 11.3 m. eq., with a mean value of 7.2 m. eq., per 100 cc. blood; 3. a control range for sodium from 7.1 m. eq. to 11.6 m. eq., with a mean value of 9.2 m. eq., per 100 cc. blood; 4. and an experimental range for sodium from 5.0 m. eq. to 12.8 m. eq., with a mean value of 9.4 m. eq., per 100 cc. blood. Our results showed a marked increase in potassium ion content

in the blood of hibernating hamsters over the normal value, while these values for sodium did not show any striking change.

13. STUDIES OF OXYGEN CAPACITY IN RELATION TO SEX.

Jack D. Burke; *University of Richmond.*

Present data indicate that the oxygen capacity of the blood of mammals varies with the species. In a consideration of these data, it is known that various factors such as size, weight, ordinal characteristics, and habitat of various species of mammals have no specific relationship to the oxygen capacity of the blood. There is, however, an indication of a sex relationship to oxygen capacity in data reported by Gregersen. His investigations were made on normal male and female Chinese. Statistical and other pertinent data were obtained in studies made on albino rats and black mice. These animals were considered normal as evidenced by their blood picture. Data obtained from these mammals are presented in order to evaluate the degree of relationship of the oxygen capacity of the blood to different sexes. Oxygen capacities were determined with the Roughton-Scholander syringe apparatus.

14. AN INVESTIGATION TO ESTABLISH THE VIABILITY EXPECTANCY OF BULBLETS OF WILD ONION AND GARLIC *Allium Spp.* OCCURRING IN FIELD CROP SEED, BASED ON SIZE AND PHYSIOLOGICAL CLASSIFICATIONS.

C. M. Bass; *Virginia Department of Agriculture.*

Aerial bulblets of *Allium* spp. frequently occur in agricultural seed. These weeds are declared as noxious under the seed laws of most states. With improved machinery, progress has been made in removing these weeds from seed commonly seen in trade channels. There remain, however, types of bulblets which processors have not been able to remove. In as much as bulblets of these weeds when found in commercial seed vary in size and frequently are damaged by processing, it was believed that because of these factors, many of them are not viable. It was contended that if such bulblets were incapable of growth they should be classified under the official rules for testing seed as "inert matter" rather than "weed seeds". A study was made to determine the effect size and mechanical injury have on the viability of questionable bulblets. The investigation was based on size and physiological classifications. The following conclusions were drawn: 1. Size of bulblets has very little influence on germination. 2. Undamaged bulblets in the hull may produce strong germination. 3. Damaged bulblets show low germinating capacity. 4. Severely damaged bulblets showed almost no germination. 5. Bulblets in the hull have a greater germination potential than those out of the hull.

15. OBSERVATIONS ON THE CIRCULATION OF THE KIDNEY OF *Rana catesbeiana.*

E. W. Pullen and H. H. Hobbs; *University of Virginia.*

Evidence obtained in using vital stains in studies of the renal circula-

tion in *Rana catesbeiana* indicates that the renal portal vein is responsible for bringing that blood to the kidney which supplies the capillary network surrounding the tubules. No evidence of glomerular supply from this source has been found.

16. TEMPERATURE AND MOISTURE IN THE ECOLOGY OF EARTHWORMS.

William C. Grant, Jr.; *College of William and Mary.*

Experiments were conducted on two species of common lumbricid earthworms, *Allolobophora caliginosa* and *Eisenis feotida* and on one species of megascolecid worm, *Pheretima hupeiensis*. The water content of each species is the same, but their vital limits of desiccation vary. *A. caliginosa* is able to withstand a loss of water equal to 63.5 percent of its initial weight. Mature and semi- mature worms of each species desiccate at a faster rate than do juveniles. *E. foetida* and *P. hupeiensis* are more active on a wet than on a dry surface, while *A. caliginosa* is relatively inactive on both. The upper lethal level for worms conditioned at 22° C. was 24.9° C., 24.7° C. and 26.3° C. for *P. hupeiensis*, *E. feotida* and *A. caliginosa* respectively. In soil chambers, *P. hupeiensis* is most effective in mixing top-soil with sub-soil. Its castings are deposited beneath, and those of *A. caliginosa* on the surface of the soil. In the field, *P. hupeiensis* generally inhabits the sub-soil, being found only near the surface in seasons when moisture is high and temperatures moderate. During the winter months it remains in a state of hibernation at deep soil levels. *A. caliginosa*, having greater tolerances in general, lives near the surface in rich top-soils, where it is subject to wide fluctuations in temperature and moisture.

17. GENETICS OF CHLORDANE RESISTANCE IN THE GERMAN COCKROACH: PROGRESS REPORT.

F. E. Jarvis, Jr., J. M. Grayson, and M. Levitan; *Virginia Polytechnic Institute.*

Reciprocal crosses were made between chlordane-resistant and non-resistant strains of the German cockroach. F_1 and F_2 progeny have been tested for resistance. Results indicate incomplete dominance. Future work will include determining resistance of back crosses and that of the progeny of paired matings within strains and between strains.

18. OBSERVATION ON THE MAYFLY FAUNA IN AN UPPER PIEDMONT STREAM IN CENTRAL VIRGINIA.

Jean E. Pugh; *University of Virginia.*

During the course of a year's study of the mayflies inhabiting tributaries of the Buffalo River in Amherst and Nelson counties, some 5000 specimens, representing 19 genera and 27 species, were collected. The family Ephemeridae is represented here by two genera with one species each; the family Baetidae by 11 genera, eight of which have but a single species, one with two, one with three, and one with five species; and the

family Heptageniidae by six genera, five of which have but a single species, and one, with two. Observations on ecological and spatial distribution as well as seasonal data for this assemblage are presented.

19. A POLAROGRAPHIC STUDY OF RESPIRATION IN A BLUE-GREEN ALGA.
S. L. Cooke, Jr.; *University of Richmond.*

The problems involved in the adaptation of the polarographic technique to the study of respiration in a blue-green alga (Myxophyceae) have been investigated. Data related to factors affecting respiration rates are discussed.

20. MORPHOGENETIC STUDIES ON THE SUBTERRANEAN AXES OF *Psilotum nudum.*
David W. Bierhorst; *University of Virginia.*

The irregular branching patterns among the sporophytic and gametophytic subterranean axes may be referred to disturbances (mechanical injuries) occurring under natural conditions to the naked apical meristems. Apical injuries may result in the production of one to several new apical cells. These, and subsequent centers of growth, may produce new axes of equal or unequal sizes. The old apex may or may not become reconstituted and continue to produce the original axis. Dichotomies, trichotomies, apparent lateral branching, bends, and constrictions may thus arise in the system. The degree of development of the stele is correlated with the bulk of the meristematic apex. There seems to be a particular diameter of the apex above which a procambium will differentiate and below which none will appear; this is approximately one mm. for both sporophyte and gametophyte. Axes with apical meristems falling in a size range close to one mm. in diameter may possess central tissues of various degrees of diffentiation, ranging from a complete stele through a series of intermediates to the complete absence of elongate elements. A discontinuous stele may be produced if the bulk of the meristematic tissue in the apex is fluctuating above and below the particular size necessary for procambial differentiation. Fluctuations in the bulk of the apical meristem appear to be directly related to mechanical injury and subsequent repair.

21. ABNORMAL OVULE DEVELOPMENT IN *Ilex opaca.*
J. M. Herr, Jr.; *Washington and Lee University.*

Variation with regard to the occurrence of abnormal ovules in *Ilex opaca* appears in two ovary collections taken on successive years in separate localities. Holly ovaries were first collected in Charlottesville, Virginia, during late Spring of 1952. The second collection was made one year later in Lexington, Virginia. All ovules examined (216) from the first collection showed normal development. In the second collection, however, approximately one out of six ovules examined (18 out of 123) showed abnormal development. Here, abnormality refers either to the cessation

of normal growth in immature ovules or to the initiation or maturing of ovules by aberrant growth characterized by the production of very large, irregularly shaped cells.

22. OBSERVATIONS OF THE EFFECTS OF SOME SUPPOSEDLY TOXIC SUBSTANCES ON EPHEMEROPTERAN NYMPHS.

James L. Larimer; *University of Virginia.*

Experiments were conducted to determine the limits of tolerance and effects of various substances on may-fly nymphs. The substances were selected according to their frequency of occurrence in streams polluted by industrial wastes. Various concentration of sulfuric acid, ferrous sulfate, calcium sulfate, and magnesium sulfate were used. Five animals were placed in 300-375 milliliters of each solution regulated to the desired concentration. The cultures were maintained in jars of about 500 milliliter capacity. These were immersed in running water to maintain a temperature below 20 degrees centigrade and an air hose was placed in each jar to furnish about 100 milliliters of air per minute. Records of the time, temperature, pH, and the number of surviving animals were made every twenty-four hours. The duration of each experiment was ten days. The test animal used was a member of the genus *Stenonema,* which is very common in the Charlottesville area, and readily available for experimental purposes.

Of the substances tested, the most toxic was sulfuric acid, and next was ferrous sulfate. Calcium sulfate was found to be less toxic than the previous two, but more toxic than magnesium sulfate. The order of toxicity runs, $H_2SO_4 > FeSO_4 > CaSO_4 > MgSO_4$.

At its business meeting, held on May 7, the Section of Biology elected the following officers for 1954-1955:

Chairman—Roscoe Hughes, Medical College of Virginia

Vice-chairman—Jacques Rappeport, University of Virginia

Secretary—Jack D. Burke, University of Richmond

Section Editor—Robert T. Brumfield, Longwood College.

MINUTES OF THE CHEMISTRY SECTION [5]

ROBERT C. KRUG, *Chariman*
J. STANTON PIERCE, *Secretary*
CARL J. LIKES, *Section Editor* (1957)

FRIDAY, MAY 7—9:00 A.M. and SATURDAY, MAY 8—ROOM 200, COBB CHEMICAL LABORATORY

Introductory Remarks. Chairman Robert C. Krug; *Virginia Polytechnic Institute.*

1. STUDIES OF THE MECHANISM OF ANTIOXIDANTS (15 MINUTES).
James W. Cole, Jr., Lewis G. Cochran, Gordon P. Brown, and Minor F. Johnson, Jr., *University of Virginia.*

Small amounts of compounds with nitrogen and sulfur functional groups decrease the rate of oxidation of fluids at elevated temperatures. Information to assist in the understanding of the mechanism of action of such antioxidants is being accumulated by measurements of rates of oxygen absorption and the determination of changes in chemical composition. Spectrophotometric measurements assist in following the course of the reaction. It appears that for these additives to be antioxidants they become activated through a mechanism involving reactions with equivalent quantities of oxygen. The effect of metal surfaces on the behavior of additives is measurable but of a complex nature.

2. THE OXIDATION OF A SINGLE CRYSTAL OF IRON.
Bruce Wagner, Jr.; *University of Virginia.*

The relative rates of oxidation of several of the major faces of a single crystal of iron have been determined using interference colors as a measure of the thickness of the oxide films. The relative rates of the major faces in the temperature range 250° to 550° C. are: (100) > (111) > (110) > (320).

Structure and composition studies have been carried out using x-ray diffraction and the optical microscope. The composition and structure of the oxide film is dependent upon the temperature, pressure, and crystal face of the iron. For example, at 250° C. and 17 mm. oxygen pressure, the oxide formed on the (100) face of iron is highly oriented, the (100) plane of the oxide (either Fe_3O_4 or $\gamma - Fe_2O_3$) being parallel to the (100) plane of the metal such that the [110] direction of the oxide is parallel to the [100] direction of iron. Preliminary invesitgations of the oxide on the (110) and (111) faces indicate one degree of orientation.

3. THE STRUCTURE OF OXIDE FILMS ON COPPER SINGLE CRYSTALS.

Kenneth R. Lawless; *University of Virginia.*

Two oxides, cuprous and cupric oxide, form on copper, the amount of each and their structure depending on the conditions of the oxidation. Cupric oxide, when present, was found in all cases to be polycrystalline with a random orientation. The structure of the cuprous oxide, which always composed the bulk of the oxide film, varied depending on oxidation conditions and on crystal face. In general, increasing the temperature or decreasing the pressure caused an increase in the amount of preferred orientation. Both the type of orientation and the amount of orientation varied with crystal face. Four major orientations were found for the cuprous oxide, with in some cases two or more orientations occurring on a given crystal.

4. THE EFFECT OF CONTAMINANTS ON THE OXIDATION OF COPPER SINGLE CRYSTALS.

Kenneth R. Lawless; *University of Virginia.*

Small amounts of various impurities of foreign substances can cause tremendous changes in various catalytic reactions and in chemical reactions such as oxidation. Experience over a number of years has indicated the extreme sensitivity of copper single crystals to the presence of trace impurities. Using single crystal spheres of copper, a standard pattern is produced by oxidation when reacting materials and apparatus, including water supply, are as free of impurities as possible. Small amounts of impurities may cause vast changes in the oxidation pattern, and thus the use of a single crystal sphere provides a very sensitive method for indicating the presence of impurities. Experiments on the influence of various amounts of phosphate, and of silicone grease on the appearance of the oxidation pattern are reported.

5. THE INFLUENCE OF FOREIGN ATOMS ON THE CATALYTIC PROPERTIES AND SURFACE STRUCTURE OF METAL SINGLE CRYSTALS.

Robert F. Cunningham; *University of Virginia.*

The catalytic reaction of hydrogen and oxygen on large crystals of copper results in the rearrangement of the surface to produce definite facets parallel to certain planes. Under some conditions copper powder is formed, the amount of which depends on crystal face. Using a copper crystal in the form of a sphere so that all possible faces were exposed at some point on the surface, it has been previously shown by the author that the rearrangement is greatly influenced by the presence of small amounts of foreign substances such as silver, zinc, and chromium oxide.

In the present studies the rates of catalytic reaction were measured on isolated crystal faces with the aid of specimens having surfaces cut parallel to important crystal planes. Small amounts of the foreign atoms were evaporated onto the surfaces. The type of facets formed by the rearrangement, the rate of the catalytic reaction on the different faces, and the

formation of copper powder were greatly influenced by the presence of the foreign atoms on the surfaces.

6. STUDIES OF THE CHEMICAL PROPERTIES OF SINGLE CRYSTALS OF SILVER CHLORIDE.[1]

Frances H. Cook; *Virginia Institute for Scientific Research.*

Studies were made of the etching of single crystals of silver chloride and of the reduction of the surfaces of single crystals of silver chloride to free silver.

Each single crystal was machined into a 5/8 in. sphere with a small shaft for handling and was mechanically polished with fine emery paper The strained surface layer was removed by etching, and the crystal was polished with wool flannel moistened with sodium cyanide solution. These operations were carried out mainly in incandescent light.

Etching studies were made in solutions of 1% sodium cyanide, 5% ammonium hydroxide, and 10% (by volume) acid fixer. Although the three etch patterns differed, each indicated that the crystal was chemically anisotropic. Deep etching in acid fixer showed a tendency for the crystal to become a polyhedron. Development of specific faces was apparent under the microscope.

Surfaces of the polished crystal were reduced to free silver by exposure to sunlight, by photographic development, and by heating in hydrogen at temperatures of 200-350° C. Patterns indicating differences between crystal faces were obtained. Microscopic silver figures, whose shape depended on the orientation of the silver chloride crystal, were formed in two developers. Somewhat similar figures were found after reduction in hydrogen.

7. APPLICATIONS OF THE FIELD EMISSION MICROSCOPE.

Peter B. Sherry; *University of Virginia.*

Field emission microscopes are used to study the heat cleaning of tungsten and the adsorption of tantalum on clean tungsten. Field emission patterns indicate that at about 1800° K. oxygen dissolved in the tungsten metal is expelled and becomes adsorbed on the surface. Heating to a higher temperature will desorbe the surface oxygen.

Tantalum diffuses readily over a clean tungsten surface at about 900° K. but tends to form small crystallites on the surface at room temperature if the tungsten is subjected to fields of about 5×10^7 volts per cm.

The vacuum system used for evacuating the field emission tubes will give pressures of 10^{-10} mm. of Hg with comparative ease.

8. THE ADSORPTION OF ORGANIC POISONS ON THE HYDROGEN ELECTRODE.

Thomas C. Franklin and Phillip Oglesby; *University of Richmond.*

A series of nitriles and amines are being investigated with regard to

[1] This research was conducted under Contract No. AF 33 (616)-323 with the United States Air Force, the sponsoring agency being the Aeronautical Research Laboratory of the Wright Air Development Center, Air Research and Development Command.

their poisoning effect on the hydrogen electrode. The potential of the electrode has been found to be a straight line function of the logarithm of the amount of adsorbed hydrogen. The logarithm of the fraction of the active area of the electrode covered by the poison has been found to be a straight line function of the logarithm of the concentration of the poison for both nitriles and amines. The strength of the poison has been found to increase with an increase in the molecular weight of the poison in the case of the nitriles.

9. AN INDUSTRIAL CHEMIST LOOKS AT FARMING (Guest Lecture). Robert H. Kean; *Virginia-Carolina Chemical Corporation.*

Agriculture, the oldest industrial art of our civilization, is just beginning to feel the full impact of our scientific age. This has resulted in a rapid decrease in the proportion of our working force required for agricultural production, and in tremendous increases in agricultural productivtiy.

The increased use of chemical products in agriculture during the past twenty years has put our fertilizer and agricultural chemical industries in the group of our fastest growing industries. It is evident that even greater growth will be needed during the coming years, both in the production of fertilizers, in chemicals for control of agricultural pests, and in other agricultural fields.

Advances in fundamental chemical science, and related sciences have been the major factor in ushering in this coming "chemical age" of agriculture. In spite of progress made, however, we are far removed from levels of chemical use that are economically and scientifically desirable.

New scientific knowledge and new research tools of great potential value are just now becoming available for research in this field. The extremely complex physico-chemical and biochemical systems involved will require research of high order, and highly coordinated among the sciences involved. Such research, which is the foundation on which the continued development of agriculture must be built, presents a great challenge and a great need.

BUSINESS SESSION

Two business sessions were held by the Section. The first was at 12:05 P.M., May 7, and was devoted primarily to the election of officers for 1954-1955, and to a preliminary discussion of a proposal, submitted at the request of Dr. Boyd Harshbarger, and relating to the publication once each year in the *Virginia Journal of Science* of the titles, authors, and references of all articles published by Virginia authors during the year. Opinion was divided on this proposal, and final action was deferred until the following day. The report of the nominating committee was presented and the following officers elected by unanimous vote of the members present:

Chairman—J. Stanton Pierce, University of Richmond

Secretary—J. S. Gillespie, Jr., Virginia-Carolina Chemical Corp

At the second meeting, held at 11:00 A.M. on May 8, the proposal relating to the annual listing of authors, etc., in the *Journal* was again discussed and the following motion made, seconded, and carried: "It is the feeling of the Chemistry Section that more *information* concerning the publication of a list of authors is highly desirable and is awaited by the Chemistry Section." Notice of this action was conveyed, as required, to Dr. R. W. Engels, Biochemistry and Nutrition Department, Virginia Polytechnic Institute.

10. EFFECT OF SOLUTE CONCENTRATION ON SURFACE AND INTERFACIAL TENSIONS OF SEVERAL LIQUID SYSTEMS.

John E. Lastovica, Jr., and Nelson F. Murphy; *Virginia Polytechnic Institute.*

Surface and interfacial tensions were determined by means of a ring-type tensiometer. The following binary systems were studied: *n*-butanol-water, methyl ethyl ketone-water, nitromethane-water, furfural-water, and cyclohexanol-water.

Tertiary systems included in the investigation were as follows: methyl ethyl ketone-acetic acid-water, nitromethane-acetic acid-water, *n*-butanol-acetic acid-water, furfural-acetic acid-water, toluene-acetic acid-water, *n*-hexane-acetic acid-water, 1,1,2-trichloroethane-acetone-water, cyclohexanol-acetic acid-water, *n*-butanol-acetone-water, carbon tetrachloride-acetone-water, benzene-acetone-water, toluene-acetone-water, and *n*-hexane-acetone-water.

The various systems were chosen mainly because of their broad application in studies on liquid-liquid extraction. The temperature of the tests was maintained at 25° C. and at 27° C. Graphical methods for correlating variations in surface and interfacial tensions with changes in solute concentration are presented.

11. A STUDY OF THE ULTRAVIOLET ABSORPTION SPECTRA OF CHALCONES (BENZALACETOPHENONES).

W. Bruce Black and Robert E. Lutz; *University of Virginia.*

The band which occurs near 250 mu in the spectra of many chalcones has been conclusively shown to be due to absorption of the benzoyl portion of the chalcone molecule (possibly the phenylvinylketone portion in certain cases) by replacement of the benzoyl phenyl with a mesityl. This replacement which necessarily makes the benzoyl portion of the molecule non-coplanar resulted in the deletion of the 250 mu band of each of the parent chalcones.

In the spectra of a series of phenylbenzoylacetyleses evidence has been found that the band which occurs near 260 mu in certain of these acetylenes is due to benzoyl absorption.

The photoequilibrium positions of a number of cis-trans chalcone pairs have been determined spectroscopically. It has been found that they usually lie far over on the side of the cis isomer; however, the photoequilibrium positions of chalcones such as the α-phenylchalcone pairs and the

α-bromo-4-nitrochalcone pair, each of which has a long conjugated system (stilbene and α-bromo-4-nitrostyrene respectively) in addition to the cinnamoyl system, lie much less in that direction. These findings in the latter cases have been related to the increased stability of the cis isomer due to the stilbene or 4-nitrostyrene system.

12. RING-CHAIN RELATIONSHIPS IN THE 2-(N-ACETAL-N-BENZYLAMINO)-1,2-DIPHENYLETHANONE AND ETHANOL SERIES. THE MECHANISM OF CYCLOTRANS-ETHERIFICATION. [1], [2]

Claibourne E. Griffin and Robert E. Lutz; *University of Virginia.*

N-Acetal-N-benzylamino-1,2-diphenylethanone and the two corresponding stereoisomeric ethanols have been prepared; and their structures were determined by ultraviolet absorption and by reduction of the former to one of the latter by aluminum iso-propoxide. Hydrolysis of the two types gave corresponding and more stable huhydroxy and monohydroxy-morpholines by essentially irreversible cyclization through the aldehyde group; the cyclic structures of these products were determined by ultraviolet absorption and by their reduction characteristics. Acid-catalyzed etherifications and trans-etherifications were easily effected in absolute alcohols. A small amount of water was necessary to effect cyclizations, however, and this is explained in terms of hydrolysis of the acetal group to the hemiacetal or free aldehyde. Dehydration of the dihydroxymorpholine gave irreversibly a hydroxydihydro-oxazine, the structure of which was shown by its stilben absorptivity. Lithium aluminum hydride reduction of this compound stopped after one stage and gave enolate-alkoxide, which only upon subsequent hydrolysis gave the then further reducible 2-hydroxymorpholine. Acid-catalyzed etherifications and trans-etherifications were easily accomplished.

13. THE PREPARATION OF DIALKYL ZINC COMPOUNDS.

Robert C. Krug and Phillip J. C. Tang; *Virginia Polytechnic Institute.*

During the course of some studies on the reaction of organo-metallic compounds with mono-chloromethyl ether considerable difficulty was encountered in the preparation of dialkylzinc compounds employing the usual zinc-copper couples. A very reactive zinc-copper couple was easily obtained from zinc dust and cupric citrate by heating the mixture in an atmosphere of nitrogen to decompose the salt to copper. The resulting couple readily reacts with certain alkyl halides to give the corresponding dialkyl zinc compounds. This new method gives easily reproducible results.

[1] This investigation was supported by a grant from the Eli Lilly Company.

[2] The term cyclo-trans-etherification is here used to include that process by which an open-chain ether linkage of the acetal group undergoes exchange of alkyls but where an oxygen atom elsewhere in the same molecule servs as thr replacing group and leads to heterocyclic ring closure.

14. STRUCTURAL EFFECTS IN THE KINETICS OF SCHIFF BASE FORMATION.
Richard L. Hill and Thomas I. Crowell; *University of Virginia.*

The second-order rates of formation of several of the Schiff bases of piperonal, including those of the four isomeric butyl amines, have been measured at 25° C. in methanol. The purpose of this work was to learn whether a functional relationship exists between basicity of the amine and rate of formation of its Schiff base. There is no such correlation between the rate and the usual criterion of base strength, ionization constant. But if the known dissociation constant for the reaction, $RNH_2 \cdot B(CH_3)_3 \rightarrow RNH_2 + B(CH_3)_3$, is taken as a measure of amine basicity, a linear relationship is found between the logarithm of the specific rate of formation of Schiff base and the free energy of dissociation of the $B(CH_3)_3$ addition compound of the corresponding amine.

15. A STUDY OF THE REACTION BETWEEN *o*-CHLOROBENZYL CHLORIDE AND NAPHTHALENE.
Frank A. Vingiello and Alexej Borkovec; *Virginia Polytechnic Institute.*

The Friedel-Crafts reaction between *o*-chlorobenzyl chloride and naphthalene yields a mixture of 2-chloro-α-nepthylmethyl benzene and 2-chloro-β-naphthylmethyl benzene. This reaction has been studied using different solvents and catalysts and at various temperatures in an attempt to obtain predominately α and β substitution at will. The experiments by which the above has been accomplished will be described.

16. β-TETRAHYDRO- AND DECAHYDROQUINOLYLETHANOL AS INTERMEDIARIES.
Charles J. Hansrote, Jr., Y. H. Chen, and J. Stanton Pierce; *University of Richmond.*

β-Tetrahydroquinolylethanol and trans-β-decahydroquinolylethanol have been found to react with p-alkoxybenzoyl chlorides and aryl isocyanates to yield esters and urethans, respectively.

17. SOME CONSIDERATION OF THE OCCURRENCE ANL STRUCTURE OF PHOSPHATE MINERALS.
D. S. Sears; *Virginia-Carolina Chemical Corporation.*

A brief discussion is given of the origin and present disposition of the chief phosphate minerals, particularly of the Florida deposits. The composition and structure of some of these minerals is considered in relation to properties and isomorphism and to the inclusion of trace elements such as uranium.

18. STUDIES ON *O, O, O*-TRIAKYL PHOSPHOROTHIOATES.
C. L. Harowitz, C. E. Setliff, and J. R. Mangham; *Virginia-Carolina Chemical Corporation.*

The general chemistry of the *O, O, O*-trialkyl phosphorothioates is discussed, including the more important synthetic methods of preparation. Also covered is a comparison of the thermal stabilities of the phosphorothioates with analogous types of organophosphorus compounds.

19. THE PREPARATION OF SOME ALKLPHOSPHORIC AMIDES.

J. R. Mangham and T. M. Melton; *Virginia-Carolina Chemical Corporation.*

A series of alkylphosphoric amides prepared by the reaction of alkylamines with phosphoric oxychloride is described. A difference is noted in the reactivity of primary and secondary amines. A new molar refractivity constant is derived for phosphorus amido nitrogen.

20. THE FUNGITOXICITY OF NICOTINE AND NICOTINE DERIVATIVES.

Lewis E. Goyete; *Virginia-Carolina Chemical Corporation.*

Thirty-five compounds structurally related to nicotine have been examined for their fungitoxicity. Included in this list were derivatives of nicotine, metanicotine, nicotinic acid, and nicotyrine.

A standard slide germination test was employed which used *Glomerella cingulata* and *Monilinia fructicola* as the test fungi. Values of ED_{50} were determined for each compound and dosage-response curves were plotted. A correlation has been made between molecular structure and fungitoxicity.

21. A LABORATORY METHOD FOR THE EVALUATION OF ORGANIC PHOSPHORUS COMPOUNDS FOR INSECTICIDAL ACTIVITY.

M. A. Manzelli and V. H. Young; *Virginia-Carolina Chemical Corporation.*

A single test method has been developed for the rapid preliminary evaluation of organic phosphorus compounds for insecticidal activity and for determination of the relative effectiveness of these compounds. The procedure is a modification of previously reported methods, and employs adults of *Tribolium confusum,* the confused flour beetle, as the test insect.

The chief advantages of the modified method are the ease of culture of uniform specimens and the ability to consistently reproduce testing results. A relatively short testing time is required (48 hours). The active response of *T. confusum* to stomach and contact toxicants, to fumigants and to a lesser degree, repellents is an added advantage. It is possible to estimate relative mammalian toxicities of organic phosphorus compounds from the median lethal doses to *T. confusum.* It is also possible to correlate, generally, the preliminary laboratory screening results with those obtained in the future in the greenhouse and field.

22. MOLECULAR DIMENSIONS OF ZEIN.

Carl J. Likes; *Virginia Institute for Scientific Research.*

As the initial phase of a project designed to investigate the chemical and physical changes which occur in zein molecules during the produc-

tion of Vicara fiber, a blended sample of commercial zein has been studied by various techniques with the object of determining first the size and shape of the undenatured and unreacted molecule. The results of viscosity, sedimentation velocity, diffusion, and x-ray studies will be discussed. The overall evidence indicates that in aqueous iso-propyl alcohol solution the molecular weight of zein is in the neighborhood of 28,000 grams per mole, and that the molecule is only slightly coiled, the shape approximating that of a prolate ellipsoid with a length to breadth ratio of about 220 A to 20 A.

23. ANISOTROPIC SWELLING OF ZEIN FIBERS.

George L. Walker, Jr., and J. Samuel Gillespie, Jr.; *Virginia-Carolina Chemical Corporation.*

Various swelling agents have been examined for their effect on zein fibers. A study has been made of swelling anisotropy of samples of commercial Vicara zein fiber. In general, it has been found that increase in crystallite orientation as determined by x-ray diffraction was accompanied by reduced longitudinal swelling and that increase in reaction with formaldehyde decreased the degree of lateral swelling of these fibers.

24. CORRELATION OF MOLECULAR WEIGHT-DISTRIBUTION DATA FOR HIGH POLYMERS.

D. W. Levi and D. S. Davis; *Virginia Polytechnic Institute.*

Correlation of molecular weight-distribution data for high polymers can be achieved through the use of a new function $\int = \log [20y/\log(100-y)]$, which facilitates rectification and differentiation.

25. CHEMISTRY OF CLORENE.

Albert W. Lutz; *College of William and Mary.*

Evidence has been found that clorene, a tricyclic isomer of the naturally occurring sesquiterpene caryophyllene, can be formulated as 4, 4, 8-trimethyl*tricyclo* $[6:3:1:0^{1,5}]$ dodec-2-ene. Direct methods of degradation of clorene were fruitless due to the extraordinary stability of its oxidation product, clorenic acid. The proposed configuration is based on an unambiguous correlation with a glycol whose structure has been elucidated.

26. THE REDUCTION OF AROMATIC NITRO COMPOUNDS UNDER ALKALINE CONDITIONS.

Ira A. Updike and Edward C. Wilson; *Randolph-Macon College.*

This paper is taken from the senior project of the junior author, Class of 1954 Randolph-Macon College. The study was supported in part by a research grant from the Virginia Academy of Science, for which thanks are given.

It is generally considered that aniline is produced by acid reduction which, of course, is the usual procedure. We report the formation of

significant amounts of aniline by reduction of nitrobenzene with silicon-sodium hydroxide in water. It has been postulated by others that beta-phenylhydroxylamine is first formed which then undergoes auto oxidation-reduction to aniline and nitrosobenzene. Independent preparation of beta-phenylhydroxylamine and heating with silicon-sodium hydroxide confirmed aniline formation. Azoxybenzene, the first bimolecular stage of reduction, was obtained by condensation of nitrosobenzene and beta-phenylhydroxylamine and the azoxybenzene was further reduced to azobenzene in good yield, but neither hydrazobenzene nor aniline was obtained by further reduction for 100 hours at 100° C. A qualitative scheme for the detection of each of the possible reduction stages of nitrobenzene in the presence of the others was worked out and will be presented at a later date. Various substituted nitrobenzenes are scheduled for study in a similar manner in the immediate future.

27. THE EFFECT OF THE MEDIUM ON THE THIOSULEATE-ETHYL BROMIDE REACTION.

Francis B. Clough, Thomas S. Russell, and James C. Salonish; *Virginia Polytechnic Institute.*

A study has been begun on the effect of added salts on the reaction of ethyl bromide with $S_2O_3^=$ in *n*-PtOH $-$ H_2O mixtures of varying proportions, in order to obtain more data with regard to the effect of dielectric constant and ionic strength on ion-molecule reactions. Published data and theoretical discussions of the problem are in part contradictory. Data obtained so far in the study indicate that the reaction rate increases with increasing dielectric constant, and decreases with ionic strength, in qualitative accord with the deductions of Amis and Jaffe. At a dielectric constant of 30 the plot of log k/k_0 *vs* square root of ionic strength is linear, even when such widely different salts as Na_2SO_4 and $La(NO_3)_3$ are present. The marked catalysis by La^{+++} observed for the reaction between $S_2O_3^=$ and bromoacetate ion is absent here, as might be expected.

28. SOME MODERN ASPECTS OF URINARY CALCULI IN RELATION TO DISSOLUTION BY ENZYMES.

Lawrence K. Claffey, David Levi, and S. Ford; *Virginia Polytechnic Institute.*

This investigation deals with the study of the dissolution of urinary calculi by various solvents in conjunction with enzyme pretreatment. A general review is made of all the solvents and enzymes used since the investigation was started in 1940.

Phosphate and carbonate calculi can be dissolved, or disintegrated to small fragments, "in vitro" by a one-hour treatment with hyaluronidase followed by a six-hour irrigation with 0.4% hydrochloric acid.

A fifteen-minute treatment with urease followed by a six-hour irrigation with 0.4% hydrochloric acid gave results similar, but somewhat less effective, than the hyaluronidase treatment indicated above.

Lithium carbonate solutions show promise as a solvent for urate type of calculi.

Density studies indicate that there is no relation between the density of the calculi and the dissolution by the various methods used in this investigation.

Swelling experiments seem to indicate that pre-treatment of calculi with hyaluronidase causes a swelling which enabels the solvent to penetrate the calculi more efficiently.

29. A NEW REAGENT FOR THE COLORIMETRIC DETERMINATION OF TRACES OF MAGNESIUM.

Charles K. Mann and John H. Yoe; *Pratt Trace Analysis Laboratory, University of Virginia.*

2-Naphthol-3-(2,4-dimethyl)carboxanilide-1-azo-(2-phenol-5-sulfonic acid) forms a dark blue color complex with magnesium ions. This reaction has been found to be useful for determining magnesium in the microgram range. Methods for removal of interfering ions, based on chloroform extraction of oximates and on ion exchange, have been developed.

30. COLORIMETRIC DETERMINATION OF BORON WITH TETRABROMO-CHRYSAZIN.

Robert L. Grob and John H. Yoe; *Pratt Trace Analysis Laboratory, University of Virginia.*

A critical study of the reaction of tetrabromo-chrysazin with boron in concentrated sulfuric acid has been made. The mole ratio of boron to reagent has been determined by three quite different methods; each gave a ratio of 1:1. The rose colored boron complex reaches maximum intensity in one hour and is measured at 540 mu. The color reaction conforms to Beer's law and is sensitive to one part of boron in 50 million parts of solution, when absorbance measurements are made in 1.00 cm. cells. The tolerance of the colored complex to many diverse ions is accomplished by distilling off the trimethyl borate. The procedure is useful for the determination of trace quantities of boron.

31. POTENTIOMETRIC MICRODETERMINATION OF HALOGEN IN ORGANIC COMPOUNDS.

Everett C. Cogbill and J. Jack Kirkland; *Universtiy of Virginia.*

Potentiometric titration of halide with silver nitrate, employing a silver-amalgamated silver electrode system, has been applied to the microdetermination of chlorine, bromine, and iodine in organic compounds. The electrodes required are easily prepared and are small in size, permitting the titration to be carried out in volumes of five ml. or less. The titration is rapid and has a precision of 0.2 per cent. Ionizable halogen in organic compounds may be titrated directly after dissolving the sample in aqueous alcohol. For substances containing non-ionic halogen, the titrtion may be applied after catalytic dry combustion of the material in oxygen.

32. A STUDY OF SPECTROPHOTOMETRIC METHODS FOR THE DETERMINATION OF TRACE QUANTITIES OF BORON.

James E. Hardcastle, Emmett H. Poindexter, and W. Allan Purcell; *University of Richmond.*

A comparative study has been made of seven spectrophotometric methods for the determination of boron, all of which are similar in that they involve measurement of the intensity of color developed on addition of a solution of an organic reagent in concentrated sulfuric acid to the sample containing boron. Such factors as the wavelength of the incident light, the reagent concentration, the sulfuric acid concentration, time of development, adherence to Beer's law, reproducibility, and sensitivity were included in the study. Based upon the data obtained, the methods employing carminic acid and 1,1′-dianthrimide seem to be the most suitable of those studied.

33. INFLUENCE OF THE CYCLOPROPYL GROUP ON THE STABILITY OF COPPER CHELATES OF 1,3-DICARBONYL COMPOUNDS.

Barbara Ann Braun and Helen L. Whidden; *Randolph Macon Woman's College.*

The purpose of this study was to determine the structure of certain copper chelates and to see whether or not any influence on the stability of those containing the cyclopropyl group could be attributed to the cyclopropyl group alone. The 1,3-dicarbonyl compounds studied were 2,4-pentanedione; 1-cyclopropyl-1,3-butanedione; benzoylacetone; 1-cyclopropyl-3-phenyl-1,3-propanedione; ethylacetoacetate: ethyl-β-cyclopropyl-β-ketoprionate; and ethyl-γ-cyclopropyl-α, γ-diketobutyrate. Stability constants for the copper chelates formed with these chelating agents were determined from absorption spectra at wavelengths which gave a maximum difference in chelate absorbancy and that of the copper salt used. Employing Job's method of continuous variation a 1:2 structure for the copper chelates was established and the dissociation constants for each compound calculated. These values are discussed and explanations given for observed variations. The results show in general that the effect of the cyclopropl group alone does not influence the stability of the chelates in many instances.

34. A PROGRESS REPORT OF THE STUDY OF COORDINATION COMPOUNDS OF POLYHYDROXYAMINES.

William E. Trout, Jr., J. Stanton Pierce, and Jane Bell Gladdings; *University of Richmond.*

Studies are being made to determine the nature of the complexes formed by 1, 3 bis(tris(hydroxymethyl) amino)-2-propanol dihydrochloride with Cu(II) and Fe(III). This compound is one of several polhydroxyamines synthesized by Pierce and Wotiz.[3] A Beckman D. U. spectrophotometer was used in the absorption studies.

[3] J. Stanton Pierce and John Wotiz, **Jour. Am. Chem. Soc.** 66, 879 (1944).

The wave length of maximum absorption for the Cu(II) chelate was found to be 600 mu at pH 7 and at pH 9, and 610 mu at pH 4. Using Job's method to determine the ratio of Cu(II) to chelating agent by absorption, a maximum was found for an approximately 1:1 ratio. This was at pH 9.

The Fe(III) chelate gave a wide absorption band from 400 mu down to 320 mu. The amine alone gave negligible absorption in this region, while $FeCl_3$ alone absorbed much more strongly than the Fe(III) chelate at 350 mu but slightly less at 400 mu. The comparison was made necessarily at pH 3. The graphs of absorption versus ratio of Fe(III) to chelating agent showed definite breaks at 1:2 and 1:1 ratios but no definite maxima. Fe(III) was held in solution at pH 7.3 and at 4:1 ratio.

35. FACTORS INFLUENCING CHELATE FORMATION.

Maxwell L. Cluett; *Pratt Trace Analysis Laboratory, University of Virginia.*

Influence of structure of the organic reagent is shown in terms of the size of the chelate ring, number of rings formed, entropy effect, basic strength and chelate stability, resonance effect, nature of the donor atom, and effect of substitution on the ligand. Effect of the metal ion is described by correlating stability constants with periodic classification and ionization potentials. Influence of charge and radius of metal ion is also shown.

36. ELECTRICAL CONDUCTIVITY OF SOME MOLTEN SALTS.

O. L. Updike, Jr., and L. B. Johnson, Jr.; *University of Virginia.*

Measurements of electrical conductivity as a function of temperature from about 350° C. to 800° C. have been made for LiCl and for a mixture containing 90 mol per cent LiCl and 10 per cent KCl. Plots of log K *vs* 1/T gave straight line segments of different slopes for the liquid, liquid plus solid, and solid.

For a liquid-solid transition the conductivity was abruptly lowered. Its lowering appeared to occur, however, 5° to 10° C. above the temperature of the transition indicated by the phase diagram. This may be an indication of a strong tendency toward crystal orientation several degrees above the transition point. There were also indications that time was a variable in this region as well as was temperature.

MINUTES OF THE SECTION OF EDUCATION SECTION [6]

JOSEPH N. PAYNE, *Chairman*
JOHN B. CHASE, JR., *Secretary*
F. G. LANKFORD, JR., *Section Editor*

FRIDAY, MAY 7—9:00 A.M.—ROOM 122, CABELL HALL

1. LEADERSHIP AS A FUNCTION OF THE SITUATION.

Kathryne C. Bentley; *Highland Springs High School.*

It was the purpose of this study to ascertain whether or not leadership is a function of the situation. A leader was defined as the one who is chosen most often by the greatest number of people.

Information from student choices of leaders for the fifteen hypothetical situations was analyzed to show (1) the number of leadership choices each student received for all situations, (2) in how many situations the same leaders were chosen, (3) in how many situations each student was chosen leader, (4) which student was chosen most often as leader for each situation, (5) a student's leadership rating in one situation as compared with his rating in the situation following, (6) a reliability scale for leadership.

Within the limits of this study the following conclusions were made: (1) Leaders can be determined experimentally. (2) From experimental studies of leadership in social situations, it is possible to predict leadership roles of the members of the group. (3) A long term association has no relation to leadership roles. A negative correlation was found between leadership and length of association. (4) Leadership is closely associated with participation in sports, social activities, and intellectual pursuits. (5) Teachers and guidance personnel can use ranking by associates to determine leaders in a group. (6) Leadership is a function of the situation to a significant degree.

2. ACCOUNTING FOR FINANCES OF CO-CURRICULAR ACTIVITIES IN SUFFOLK HIGH SCHOOL.

Arthur E. Jones, Jr.; *Assistant Principal, Suffolk High School, Suffolk, Virginia.*

After the above study of schools in the Tidewater area, of which Suffolk is one, it seems there is a need for a well-planned central accounting system for the handling of all finances in co-curricular activities. In view of this, the following recommendations were made:

1. All schools, regardless of enrollment, number of staff, or number of activities, should have a central accounting system for the finances of the co-curricular activities.

2. Persons responsible for collecting funds from the various accounts should be bonded for the protection of the school and the individual.

3. The administration should make public at least quarterly the status of all school accounts carried in the central accounting system.
4. At the end of each month the administration should present to the superintendent and school board a complete report of all activities carried in the central accounting system.
5. The central account books should be audited by a certified public accountant at the end of each school year. A copy of this audit should be included in the principal's report to the superintendent and school board.
6. All accounts should be controlled by a double signing check system.

3. A SURVEY TO DETERMINE THE EFFECTIVENESS OF STATE-WIDE AND LOCAL TESTING PROGRAMS CONDUCTED IN COOPERATION WITH THE RESEARCH SERVICE OF THE STATE DEPARTMENT OF EDUCATION.

James B. Patton, Jr., *State Department of Education.*

4. THE EFFECTIVENESS OF THE STATE-WIDE AND LOCAL TESTING PROGRAMS.

Alfred L. Wingo and James B. Patton, Jr.; *Virginia State Department of Education.*

It was the purpose of this study to determine the effectiveness of the Virginia State-wide and Local Testing Programs. A compilation and analysis were made of responses to items on a questionnaire returned by 2,915 school personnel. The items on the questionnaire elaborated these key questions: (1) What information about (or better understanding of) pupils have you obtained through the use of standardized tests provided in connection with the State Testing Program? and (2) How have you used this information in the modification or improvement of your instructional practices?

Eighty-six school divisions, comprising 22 cities and 72 counties, participated in the survey. The personnel represented included 2,537 teachers, 307 principals, 35 supervisors, 13 directors of instruction, 4 guidance personnel, 7 librarians, and 12 miscellaneous groups and unidentifiable positions. A tabulation was made of the responses to each item on the questionnaire. Recorded was the number of persons responding to each item, their school positions, the number who checked each item "yes", and the percentages of such responses. The complete tabulation shows classifications by cities and counties, white and Negro, and a grand total of the responses to each item.

A tabulation of the responses to items elaborating the question concerning information obtained through the use of standardized tests showed that a substantial majority of the teachers reporting had gained useful information about their pupils. A substantial majority of the teachers also indicated that the information gained had resulted in modifications or improvement of their instructional practices. There were 2,230 teachers who reported their preferences regarding the use of standardized tests as a part of their teaching equipment, and 1,976 of them, or 88.6 per cent, preferred to use tests. The percentage of administrative, supervisor

and other non-teaching personnel favoring the use of standardized tests was even higher, being 94.8 per cent. In the opinion of the authors, these findings are significant.

5. PRE-FRESHMAN MATHEMATICS IN STATE COLLEGES AND UNIVERSITIES.

Louise Hunter; *Virginia State College, Petersburg, Virginia.*

It was the purpose of this study to ascertain the status of pre-freshman mathematics in state colleges and universities. The major findings of the study were:

(1) Two hundred (or 74 per cent) of 269 institutions offered pre-freshman mathematics. The groups in which the highest percentages of the institutions offer pre-freshman mathematics were the junior colleges (92 per cent), land-grant colleges (85 per cent), and the technical college (73 per cent).

(2) Placement tests and admission units were the most widely used bases for selection and assignment of students to classes.

(3) Fifty-eight per cent of these institutions offer courses of this type for college credit. Forty-three per cent give non-credit courses in pre-freshman mathematics.

(4) Algebra is most frequently the content of pre-freshman mathematics courses. Seventy-eight per cent of the 200 institutions offer algebra.

(5) The instructional staff for such courses is the regular faculty in 93 per cent of the institutions.

(6) Textual material of greatest frequency was algebra.

(7) Eleven per cent of the institutions evaluated their results in pre-freshman mathematics as "excellent." Thirty-eight per cent gave ratings of "good," thirty-three per cent gave ratings of "average", fourteen per cent gave no rating.

(8) An estimated average of 78 per cent of students pass such courses. About 65 per cent of these students continue in college mathematics. Approximately 67 per cent of these succeed in college mathematics.

(9) Average of enrollments in pre-freshman mathematics in the technical colleges 132, in the state universities 400, land-grant colleges 400, teachers colleges 90, liberal arts colleges 170, junior colleges 65.

(10) Among important conclusions is the one that most satisfactory results seem to be obtained in offering pre-freshman mathematics where instructors have been free to do research with the problems of pre-freshman mathematics and write their own textbooks for such courses.

6. PROGNOSTIC VALUES OF FRESHMAN TESTS.

Walter N. Ridley; *Virginia State College.*

In this study six test results from each of 337 students in the 1947 and 1948 freshman classes majoring in agriculture, commerce, elementary education, physical education, and biology were used to determine the prognostic values of standardized tests regularly given at Virginia State College. Ways of improving the uses of these tests are suggested. Attention was given to estimates of prognostic values by freshman advisers, to

statistical estimates, to comparisons of advisers' and statistical estimates, and to those combinations of test performances which yield best estimates of student success.

Grade-point averages in all courses indicated the criterion, success in the major. Data were analyzed through ranges, ranks, means, standard deviations, coefficients of correlation (including simple, partial, and multiple regression statistics of zero, first, and second orders), simple and multiple regression equations, and appropriate measures of sampling errors.

Variations in prognostic values of these tests were found. Each one of the six results yielded a zero-order correlation as high as 0.50 with success in at least one major field. In four fields there was at least one zero-order correlation as high as 0.54; in two fields as high as 0.63; the highest as 0.68. Partial correlations in many instances were higher.

Freshman advisers as individuals and groups differed in their estimates. They varied from and were usually higher than statistical estimates of the prognostic values of the tests. It is estimated that prediction efficiency may be increased as much as 33% in one field, 26% in another, 17% in two fields, and only 9% in one field through proper use of regression statistics from this study.

7. A STUDY OF COMPETENCIES NEEDED BY SCHOOL ADMINISTRATORS AND SUPERVISORS IN VIRGINIA WITH IMPLICATIONS FOR PRESERVICE EDUCATION.

Prince B. Woodard, *Danville Public Schools.*

The study had a three fold purpose. First, it attempted to determine what competencies are needed for certain public school administrative and supervisory positions. Second, the essential competencies for each position were compared to determine the extent to which the same competencies are needed for all positions. Third, suggestions were made for a program of preservice education designed to develop the competencies essential for school administrators and supervisors.

The major findings of the study were as follows:

1. The survey of professional literature showed that the competencies reported as essential for the positions of school principal, school superintendent, and school supervisor respectively, are similar.

2. A large majority of the competencies reported in professional literature as essential for one or more of the positions of school principal, school superintendent, or school supervisor, were also reported as essential or of much value for these positions by each of the validating juries utilized in this study.

3. A majority of each of the validating juries of public school administrators and supervisors reported that their professional training had been adequate for 45 per cent or more of the total list of competencies .

4. A majority of each of the selected juries of public school administrators and supervisors was of the opinion that the proper place for instruction and experience in 90 per cent or more of the competencies was in both the preservice and inservice training programs.

5. Preservice training programs for school administrators and supervisors as currently offered in the selected group of institutions surveyed contained few required courses common to all programs.

6. The major portion of the preservice training program for both school administrators and supervisors should be concerned with the development of competencies in the ten areas considered essential for both administrative and supervisory positions by the validating juries utilized in this study. These areas were:

Function and Scope of Public Education
Communications
Educational Foundations
Human Relations
Community Relations
Curriculum
Instructional and Guidance Activities
Supervisory Services
Evaluation and Research
Related Educational Agencies

7. Specialized training designed to develop different competencies in the five areas of Related Disciplines, Personnel Administration, School Organization and Management, Financial and Budgetary Services, and Construction, Operation, and Maintenance of School Plant, should be provided in the preservice training programs for the five administrative and supervisory positions included in the study.

MINUTES OF THE SECTION OF ENGINEERING [7]

ROBERT W. TURITT, *Chairman*
PHILLIP L. MELVILLE, *Secretary*
ROBERT M. HUBBARD, *Section Editor* (1958)

FRIDAY, MAY 7 and SATURDAY, MAY 8—9:00 A.M.—ROOM 39, THORNTON HALL

1. ROAD ROUGHNESS MEASUREMENTS ON VIRGINIA'S PAVEMENTS.

T. H. Forrer; *Virginia Council of Highway Investigation and Research, University of Virginia.*

The Virginia Council of Highway Investigation and Research studies pavement riding qualities as one of its continuing research projects. Measurements are made on all new concrete and much of the new bituminous pavements built in the Old Dominion. Comparisons of riding qualities and lasting characteristics of pavement surfaces are made from these measurements. Roughness readings can be used to stimulate competition among contractors as to who can produce the smoothest riding pavement.

Virginia's roughometer was built from plans developed by the U. S. Bureau of Public Roads. The machine is a single wheel trailer which is towed by a panel truck. It operates as a horizontal pendulum in dynamic balance so that it is not materially affected by the towing vehicle.

Before each operation the machine is carefully checked to assure constant tire pressure, oil level in the damping pots and other conditions. It is then towed through the project at 20 mph. For any pavement length, units of roughness are measured cumulatively in inches by the integrator and expressed in inches per mile.

Road roughness measurements are an important part of the constant effort to make Virginia's highway system ever safer, more comfortable, and more enjoyable for the motoring public.

2. AN AUTOMATIC TUNING BANDPASS FILTER.

H. L. Beazell, Jr.; *University of Virginia.*

The signal from a doppler radar velocimeter normally contains a considerable amount of noise and other interfeernce. In the Sperry Model 10A Velocimeter the desired signal frequency range is 3kc. to 30 kc. To improve the quality of this signal previous to recording, a tracking filter was constructed which has an effective band width of 800 cycles and automatically follows a frequency varying signal between 3kc. and 30 kc.

The filter operates by converting the incoming signal and passing it through a 70kc. fixed tuned amplifier having a bandpass of 800 cycles.

The signal is reconverted to the original frequency by mixing with the conversion oscillator signal. This output is then passed through a 30kc. low pass filter and amplified by an automatic gain control amplifier.

Since for proper operation the output of the fixed tuned amplifier must be maintained at 70kc., by passing a portion of this output through limiters and a frequency discriminator tuned to 70kc., an error signal is obtained that indicates the direction of tuning error of the conversion oscillator. To provide automatic tracking the error signal is applied to a servo amplifier. The motor of the servo system is geared to the shaft of the tuning condenser of the conversion oscillator.

3. ORGANIZING MECHANICAL DESIGNS.

B. A. Niemeier; *Faultless Engineering and Machine Corporation*

The role of the engineer in planning physical devices for society is reviewed as an introduction to outlining the key individuals in planning a mechanical design. Emphasis is laid on the responsibility on the part of the draftsman, engineer, checker, as well as the authority who approves the design for an issuing company. A title block and cross reference system of numbering the assembly, sub-assembly and detail drawings, are presented. In defining items on the assembly drawing which are to be drafted further as a sub-assembly the author recommends surrounding such encircled item numbers with squares.

4. PRESSURE DISTRIBUTION AROUND A CIRCULAR CYLINDER IN A TWO-DIMENSIONAL NON-UNIFORM FLOW.

Joseph Hendricks; *Virginia Polytechnic Institute.*

The stream function for a circular cylinder in an incompressible, inviscid fluid having a non-uniform velocity distribution at infinity was developed by H. T. Nagamatsu. An expresson for the pressure coefficient can be derived, and the pressure distribution around the cylinder predicted. The equation for the pressure coefficient predicts a higher maximum velocity and a higher negative pressure on a cylinder in shear flow as compared to the pressures on a cylinder in a uniform flow. The increase in the maximum velocity and pressure is a function of the vorticity or curvature of the velocity distribution and the diameter of the cylinder.

A non-uniform velocity distribution has been obtained in a subsonic wind tunnel. The pressure distributions on six circular cylinders immersed in the shear flow was measured. These pressure distributions are compared to the theoretical results and also to the distribution on a cylinder in the uniform flow of a real fluid.

The experimental results show that the maximum negative pressure is greater at an angle of $\pm 90°$, and that the point for $C_p = 0$ is approximately $\pm 50°$ from the direction of flow. While in the uniform flow the maximum negative pressure occurs at approximately $\pm 70°$, and $C_p = 0$ is at $\pm 39°$.

5. P-V-T RELATIONSHIPS FOR TRICHLOROMONOFLUOROMETHANE.

Robert L. Brehm and D. S. Davis; *Virginia Polytechnic Institute.*

For superheated trichloromonofluoromethane, V, the specific, V, the specific volume, in cubic feet per pound, T, the temperature in degrees Rankine, and P, the pressure in pounds per square inch absolute, are related by the equation

$$V = \frac{T - 2.066\ P + 0.00392\ P^2}{13.84\ P^{0.9592} - 1.00},$$ which is reliable to about 0.8 per cent.

6. INVESTIGATION OF PRESSURE DISTRIBUTION OF A 180° WEDGE.

R. W. Truitt and J. C. Williams, III; *Virginia Polytechnic Institute.*

Investigation of small angle wedges in bounded and unbounded, compressible and incompressible flow has been treated in literature, however, the limiting case, the 180° wedge, has not been investigated until recently. In this paper, the 180° wedge is analyzed for incompressible flow in both bounded and unbounded streams by the Schwartz-Christoffel transformation. It is found that theoretically the boundaries (wind tunnel walls) do not appreciably affect the pressure distribution on the front fact of the 180° wedge for tunnel-wedge ratios above 7.

An experimentally determined pressure distribution on the front face of a 180° wedge in an unbounded stream, at a free stream Mach number of 0.1 was corrected for compressibility by the Sound-Space Theory. The local Mach number on the front face of the 180° wedge was not constant in the transonic range as is normally assumed for small angle wedges. For every subsonic free-stream Mach number in the range of 0.6 to 1.0 there is a corresponding supersonic free stream Mach number at which the local Mach number distribution is identical. This local Mach number distribution was converted to p_L/p^* values and checked against experimental work by Griffith at Princeton.

7. SKID TESTS FOR SAFETY.

Alfred W. Maner; *Virginia Department of Highways.*

The Virginia Department of Highways has been conducting skid resistance measurements on Virginia pavements since 1947. Approximately 3,000 skid tests have been made on bituminous surfaces containing such aggregates as limestone, granite, natural stand, manufactured stone sand, and blast furnace slag. Other surfaces tested include concrete, natural rock asphalt, and sand-asphalt containing small amounts of natural, synthetic, and reclaimed rubber.

Equipment used consists of a stock 1950 automobile, a detonator for firing a piece of chalk onto the pavement when the brakes are applied, a water truck, a 100 foot tape, signs and barricades. A new fifth wheel attachment for the test car will measure the accurate speed of the car and the stopping distance for the test.

Briefly, the test procedure is as follows: The water truck wets the pavement surface. The driver runs the test car onto the wet pavement at a predetermined speed (10, 20, 30, or 40 miles per hour), applies the brakes, and the car skids to a stop. The stopping distance is measured and recorded and the coefficent of friction is computed.

Results are used to accumulate data on various surface types for analysis, for planning resurfacing programs, and for investigating accidents.

8. SOME PROBLEMS OF BEAMS RESTING ON ELASTIC FOUNDATIONS INCLUDING EFFECTS OF SHEAR AND NORMAL PRESSURE.

Dan Frederick and Frederick G. Blottner; *Virginia Polytechnic Institute.*

An approximate solution which includes the effects of shear and normal pressure is deduced for a beam resting on an elastic foundation using the equations of elasticity. The theory is then applied to two problems and compared with the results obtained by the classical theory. The two problems considered are: (a) a semi-infinite beam with a moment on the end, and (b) a finite beam with clamped ends deflected by equal loads on its ends.

9. MODEL STUDIES OF PILE FOUNDATION SUBJECT TO LATERAL LOADING.

R. K. L. Wen; *Virginia Council of Highway Investigation and Research, University of Virginia.*

Tests were made in three series, namely: single pile, group of two piles, group of three piles. Each series consisted of four tests. Both vertical and battered piles were used.

Model piles were made of 1½" square white oak 45" long. S. R. 4 strain gauges were installed on opposite sides of each pile along its length, making it possible to segregate axial strain and flexural strain. Piles were clamped by two steel channel pieces simulating a concrete cap. Vertical and horizontal translations and rotation were measured with three mechanical dials. A tank filled with fine beach sand was used as a test pit.

Test results indicate: (1) Battered piles are advantageous in resisting lateral load. (2) Piles battered in the direction of the horizontal load offer greater resistance than piles battered against the load. (3) As horizontal load increases, the front pile or piles take up a greater proportion of external load. When horizontal load approaches the magnitude of vertical load, the average ratio of horizontal load taken by the piles is about 2:1 for two-pile group and about 7:5:3 for three-pile group, with the front pile taking all the vertical load plus the tensile force developed on the back pile or piles.

10. GUIDED MISSILE AIRFRAME RESPONSES.

C. D. West; *McDonnel Aircraft Company, St. Louis, Missouri.*

11. REVERIES OF AN ENGINEER.

W. R. Glidden; *Virginia Department of Highways.*

By extrapolating the record of history man can forsee either the destruction of civilization or its continuance for centuries; there is historical basis for either outlook. A minimum of government by honest intelligent people of the world, possibly after amalgamation of the present races, with an effort to obtain the greatest dissemination of knowledge and dispersion of advanced culture constitutes our main reliance for the future of civilization.

12. STRUCTURAL APPLICATIONS OF ALUMINUM ALLOYS.

Charles N. Gaylord; *University of Virginia.*

Aluminum alloys have been successfully used for many types of Civil Engineering structures. The two alloys generally used are 14S-T6 and 61S-T6. 14S-T6 is a high strength alloy with a basic allowable tensile working stress of 22 ksi and 61S-T6 is a moderate strength alloy of high resistance to corrosion.

Aluminum floor beams, stringers, and tread plates were used in the rehabilitation of the Smithfield Street Bridge, Pittsburgh, replacing the original iron floor beams and stringers and timber floor. The reduction in the panel dead load permitted an increase in the allowable live load from 13 ton trucks to 20 ton trucks.

One 97.5 ft. unit of the Grasse River Bridge was constructed entirely of aluminum. Because of the high base price of the metal and the inefficient use of the web material, aluminum cannot compete economically with steel in application to plate girders.

The applications where aluminum can be used to advantage are in bridge floors, bascule and lift bridges, suspended spans of cantilever bridges, and curtain walls for buildings.

13. SOME FUNDAMENTAL THEOREMS ON SIMILAR AND DISSIMILAR ELASTIC MODELS.

Daniel Frederick; *Virginia Polytechnic Institute.*

Four theorems concerning elastic models are deduced from the equations of linear elasticity. Considering the initial and deformed states, it is seen that the final states may be dissimilar although the initial states were similar.

Equations relating the loads, moments, displacements, stresses, and strains between the model and prototype are also given for each of the four cases. Two of the theorems deal with materials having different elastic constants.

14. THERMAL ANISOTROPY AND CONDUCTIVITY OF NYLON 66.

Arthur C. Doumas and Robert A. Fisher; *Virginia Polytechnic Institute.*

The thermal conductivity of nylon 66 as a function of internal structure and direction of heat flux was studied. The internal structure of cast

nylon was varied by cold-rolling and annealing, and the effects of these treatments were followed by measuring the degree of crystallinity and thermal conductivity. The density of cast nylon was increased from 1.1349 at 25°/4° C. to 1.1508 at 25°/4° C. by these treatments, and the degree of crystallinity was increased from 18.6 to 30.8 per cent. The rolling operation produced orientation of the nylon molecules, and also resulted in anisotropy of thermal conductivity of the nylon.

15. THE CONSTRUCTION OF INFLUENCE LINES WITH A MECHANICAL INTERFEROMETER.

James Howard Sword; *Virginia Polytechnic Institute.*

Influence lines have proved to be a useful tool for structural designers. Several methods of constructing these lines by means of models have been used with varying degrees of success. A different technique, employing mechanical interferometry, has been investigated. Three models have been tested. The models, cut from a ruled sheet of cast Lucite, included a fixed-ended beam, a two-span continuous beam and a symmetrically haunched arch. Influence lines for moment at a support and for end reaction or shear have been drawn for all three models. In addition, the influence line for thrust was drawn for the arch. The experimental results thus far obtained agree very closely with the results of theoretical investigations.

16. FLOW VISUALIZATION BY SCHLIEREN TECHNIQUES FOR MIXING STUDIES.

Barbour B. Wilson and O. L. Updike, Jr.; *University of Virginia.*

Schlieren techniques have been used to study high velocity gas streams for many years, but they are not usually considered for low speed flows. They will, however, show up density differences in a gas, whether from differences in temperature, in pressure, or in composition. Mixing of different gases may thus be studied. The present work deals with carbon dioxide injected into an air stream. Equipment has been assembled with a concentrated-arc light source and a single parabolic mirror, and mixing patterns have been photographed. Further studies are expected to yield correlations of mixing distance with injection method and with velocities of air and injected gas.

17. AN INVESTIGATION OF FURNACE WALL HEAT LOSS.

F. A. Iachetta; *University of Virginia.*

A study was made of a method used for furnace wall design. The design procedure assumes temperature values which are used to estimate the heat lost by radiation and convection. In this case, convection is considered to be 50% of the radiation loss as compared from the assumed temperatures. Based on this heat loss, refractory and insulation materials are selected.

The losses of a furnace wall were determined using temperatures measured by thermocouples placed in the wall. These temperatures, together

with k factors of the wall materials, were used to calculate the heat conducted through the wall which was transferred to the ambient air by radiation and convection.

A method was devised to make possible the calculation of convection. The value of air velocity was needed to permit use of forced convection rather than a natural convection analysis. This work was based on the assumption that air velocity, usually unknown where natural convection is involved, was the only quantity preventing a forced convection analysis.

The results indicated reasonably good agreement between average measured heat loss values and predicted values, though the convection investigation results were not wholly satisfactory. Recommendations, however, were made pertaining to test procedure refinements intended to improve results.

BUSINESS MEETING

Chairman R. W. Truitt called the business meeting to order at 4:00 P.M. Friday, May 7. It was agreed that the award made to a Junior Scientist should be continued; a motion was made, seconded and carried that the new chairman should head the award committee for the next year. The chairman appointed Messrs. Murphy, Melville, and Updike as judges for the 1954 award. From four competitors describing their exhibits, Walter S. Thomas from Kempville High School was selected as the recipient. The officers elected for the year 1954-1955 were:

Chairman—Phillip L. Melville

Secretary—Dudley Thompson

18. AN INSTRUMENT FOR RECORDING THE EARTH'S ELECTRIC FIELD.

Robert F. Fleming, Jr.; *University of Virginia.*

As an insulated probe is alternately exposed to and shielded from the earth's electric field, an alternating voltage is inducted on the probe. This voltage is amplified, switched at a synchronous rate, and applied to a graphic indicator as a direct current which is proportional to the polarity and magnitude of the earth's field, thus providing a plot of field vs. time.

19. EXTRACTION AND EVALUATION OF TOBACCO SEED OIL.

Robert A. Fisher; *Virginia Polytechnic Institute.*

The oil content of dry Virginia Burley tobacco seed has been found to be 40.7%. Cold pressing yielded 11% oil, hot pressing 17% and solvent extraction yielded the total oil content. Cold pressed oil was slightly superior in quality to hot pressed and solvent extracted oil, but the difference was not great. The component fatty acids of tobacco seed oil are oleic, linoeic, and a small percentage of saturated acids; the iodine number of seeds collected from six states varied from 110 to 135. Linseed oil contains linolenic acid in addition and its iodine number is 170 to 200.

In spite of its relatively low iodine number, tobacco seed oil was substituted for linseed oil in the preparation of an alkyd resin with completely satisfactory results. Interior varnish formulated with ester gum and turpentine, and spar varnish formulated with dehydrated castor oil and modified phenolic resin were prepared with linseed oil and with tobacco seed oil. The tobacco seed oil varnishes required 10 to 25 per cent longer drying time, but the film was equal to linseed oil varnish in all respects and in some cases was superior in resistance to hot water and alkali.

20. EFFECT OF ULTRASONIC INSONATION ON SOLVENT EXTRACTION OF OIL FROM PEANUTS.

Dudley Thompson and D. G. Sutherland; *Virginia Polytechnic Institute.*

This investigation was concerned with the determination of the effect of intensity and time of 400-kilocycle insonation on solvent extraction of oil from peanuts. Normal hexane was employed as solvent. Insonation times included; one-fourth, one-half, one, two, four, and six minutes. Intensities of insonation were observed in terms of radio-frequency energy produced at the power tubes of the generator and were approximatly 40, 160, 260 and 390 volt-amperes. Extraction was increased by insonation and was proportional to time and intensity. Comparison was made with samples subjected only to mechanical agitation and thermal energy. At maximum intensity insonation, 390 volt-amperes for six minutes, extraction was about 2.7 times greater than extraction accomplished in a control sample. Increased extraction was attributed to (1) dispersion of adhered particles of feed, (2) partial disruption of oil cells, (3) extended phase boundaries, (4) microagitation at phase boundaries, and (5) thermal effect.

21. PRESSURE DISTRIBUTION ABOUT DIAMOND AIRFOILS IN A TWO-DIMENSIONAL INCOMPRESSIBLE FLOW.

Fred W. Martin; *Virginia Polytechnic Institute.*

In recent years considerable work has been done on diamond-shaped bodies in supersonic and transonic flow. For the most part, however, the theoretical analysis used considers the characteristics of the flow and utilizes the Hodograph Transformation. Although this type of investigation lends itself readily to the high transonic range, it is not applicable to the sub-critical subsonic range. On the other hand, the general solution for any body in a subsonic compressible flow utilizes the incompressible pressure distribution, which is corrected for compressibility by the Prandtl-Glauert method, Karman-Tsien method, or by some similar method. Nowhere in the literature, however, is there evidence of a solution for the pressure distribution over a diamond profile in an incompressible fluid; and consequently, there is no known solution for a diamond profile in a subsonic compressible flow.

In this paper the solution of the incompressible pressure distribution for double-wedge profiles is obtained by making use of the mapping theorem of Schwarz and Christoffel. The analytical results are given for the sym-

metric case, and these results are compared with the experimental results obtained in the VPI wind tunnel.

22. PRINCIPAL STRESS TRAJECTORIES IN GEAR TEETH.

E. D. Harrison; *Virginia Polytechnic Institute.*

The Lewis' equation is the basic standard for the design of gear teeth. This formula involves, in addition to the strength of the gear material, several dimensions based on the geometry of the tooth. Assumptions regarding loading, stress concentrations, tooth deflection and the assumed tooth form are made. By substituting in the basic equation, a value of allowable stress for the material used is determined experimentally.

This paper demonstrates a method of accurately approximating the actual stress gradients by the application of photoelastic techniques. The knowledge of these gradients makes unnecessary the determination of stress concentration factors and furnishes accurate tooth hardening information.

Values of the difference of the principal stresses at each of a network's grid nodes are determined from photoelastic information. The sum of the principal stresses is determined at each of the same points by establishing boundary conditions and applying an iteration process to the Laplace differential equation for the sum of the stresses.

Values of the principal stresses at each node can be determined and smooth stress contours and gradients drawn. A study of their relation to the "difference of the principal stress" gradients permits approximate sketching of principal stress gradients for other cases.

23. COUNTERCURRENT FLOW OF TWO-PASE LIQUID-LIQUID SYSTEMS.

Nelson F. Murphy and John E. Lastovica, Jr.; *Virginia Polytechnic Institute.*

So-called counter-current flow of fluids was demonstrated in a horizontal tube of rectangular cross-section with glass walls. Moving pictures taken through the walls of a dye stream introduced into the phases show that at high differential velocities, the phases move in the same direction at the interface. There is a plane of zero velocity (relative to the walls) which moves up and down depending on the relative velocities and densities of the phases. The significance of this behavior is discussed relative to the two-film mass transfer theory and to the variation of mass transfer coefficients in liquid-liquid extraction.

24. EFFECT OF A 400-KILOCYCLE INSONATION ON THE EXTRACTION OF ACETONE FROM CARBON TETRACHLORIDE WITH WATER.

Dudley Thompson and L. P. Murray, Jr.; *Virginia Polytechnic Institute.*

The purpose of this investigation was to evaluate a liquid-liquid extraction unit incorporating 400-kilocycle insonation and to study the effect of the ultrasonic field on the rate of mass transfer. Acetone was extracted from a feed containing 13.78 ± 2.72 weight per cent acetone in carbon

tetrachloride (saturated with water) using water as the solvent. A single-contact, continuous-flow extractor was used. Variables investigated were: solvent-to-feed ratio, flow rate, and intensity of insonation. Rate of acetone extraction was increased by ultrasonic insonation. An increase in stage efficiency of the extractor was observed when the system was insonated at 400 kilocycles with an intensity that exceeded 100 milliamperes plate current, regardless of solvent-to-feed ratio. The increase was only apparent when the total flow rate of extract and raffinate phases was greater than 32 grams per minute. Maximum increase in stage efficiency of 21.8 per cent, from 75.1 to 96.9 per cent, resulted with a solvent-to-feed ratio of 1:3 (on a weight basis) and a total flow rate of 120 grams per minute when the system was insonated at 200 milliamperes plate current. Bulk agitation and microagitation at the solvent-feed interfacial boundary aided extraction by increasing the effective area available for mass transfer.

25. LOW COST STUDY OF SUPERSONIC FLOW.

David P. Lalor with James E. May and E. C. McClintock; *University of Virginia.*

Most high-speed aerodynamic model testing is now done in small, costly wind tunnels, each one restricted to a narrow range of transonic or supersonic velocities. Instructional uses, however, demand inexpensive and extremely flexible test apparatus. The water table, a relatively new device for supplementing wind tunnel studies, meets these requirements by utilizing the "hydraulic analogy" (and also makes possible investigation of acceleration and deceleration). Specifically, wave height and standing depth relationships are considered as directly analogous to those of local air density and air stream density.

Under construction at the University of Virginia is a student-designed and built table 25 x 4 feet, holding ¼ to 1½ inches of water. Two-dimensional models up to two feet in length are towed at relatively low velocities; sonic conditions can be simulated at speeds of less than one foot per second in ¼" of water. To determine pressure distribution, wave heights are measured either photographically or electronically.

The water table is an excellent undergraduate project. For $200 and 100 student hours, an accurate, practical piece of equipment for high-speed flow study and research can be developed. Also, meeting the problems of design and construction is an educational experience for prospective engineers.

26. EFFECT OF SEED STRUCTURE ON THE EXTRACTION OF OIL FROM TOBACCO SEED.

Jesse M. Carr and Robert A. Fisher; *Virginia Polytechnic Institute.*

Tobacco seed were crushed in a differential roll mill with a roll gap of 0.005 inch. The seed crushed either had their seed coat intact or removed by scarification, accomplished by use of a saturated sulphuric

acid-potassium dichromate solution. The oil yield from the seed crushed with their seed coat intact was compared with that of seed which had the seed coat removed. The seed samples were extracted in a continuous-flow extractor using trichloroethylene, isopropyl alcohol, normal hexane, and petroleum ether.

Sections of tobacco seed after extraction were compared microscopically with seed sections that had not been extracted. Sections of seed in various stages of extraction were also studied. All sections before being studied wre stained with Sudan IV, a selective stain for oil droplets in tissue.

It was found, both on microscopic examination of seed sections and on comparison of oil yields, that the seed coat was the principal resistance in all cases. The removal of the seed coat increased the oil yield 6.8% for normal hexane and 10.8% for petroleum ether.

MINUTES OF THE SECTION OF GEOLOGY [8]

WAYNE E. MOORE, *Chairman*
WILLIAM T. HARNSBERGER, *Vice-Chairman*
MARCELLUS H. STOW, *Secretary*
W. D. LOWRY, *Section Editor* (1958)

FRIDAY, MAY 7, 1954—9:00 A.M.—ROOM 303, BROOKS MUSEUM

1. SOME CURRENT ACTIVITIES AND PROJECTS OF THE VIRGINIA GEOLOGICAL SURVEY.*

William M. McGill; *Virginia Geological Survey.*

The main activities and projects of the State Geological Survey for the past year and those now in progress or planned for the next year are reviewed together with a listing of publications recently issued, in press, or scheduled for publication in the next fiscal year.

2. INFOLDED METASEDIMENTS NEAR THE AXIAL ZONE OF THE CATOCTIN MOUNTAIN-BLUE RIDGE ANTICLINORIUM IN VIRGINIA.*

Edwin O. Gooch; *Virginia Geological Survey.*

A belt of metasedimentary rocks about 60 miles long and from half a mile to two miles wide occurs in the northwestern Piedmont of Virginia, near the axial zone of the Catoctin Mountain-Blue Ridge anticlinorium, the core of which is composed of a complex of granitoid and gneissoid rocks. This complex is overlain in the eastern limb of the anticlinorium by the Lynchburg formation and by the Swift Run formation in the western limb. The writer interprets the belt of metasedimentary rocks as a series of two large and two very small infolds in the basement complex. The infolds are isoclinal and overturned towards the northwest in the southern part of the structure but are more open in the northern part. In places reverse faults cut the folds.

The rocks of the Lynchburg and Swift Run formations and the metasedimentary rocks were derived from the basement complex. Recent theories are that the Lynchburg formation overlaps the basement complex from east to west and that the Swift Run represents the thinned western edge of the overlap. Thus the Lynchburg and Swift Run formations are considered to be equivalent. Geographically, the belt of metasedimentary rocks is about halfway between the Lynchburg formation on the east and the Swift Run formation on the west. The writer correlates the metasedimentary rocks with the Lynchburg-Swift Run formation.

* Presented with the permission of the State Geologist of Virginia.

3. CAVITY FILLINGS OF RED LIMESTONE IN THE ORDOVICIAN, AUGUSTA COUNTY, VIRGINIA.

An inactive quarry, four miles southwest of Staunton and half a mile east of the intersection of U. S. Highway 11 and State Road 624, contains brecciated New Market and Lincolnshire limestones. The matrix of the breccia and the associated cavity fillings is red limestone.

In some of the cavity fillings are pellets of white clay, illite. Other insoluble minerals identified in the matrix are detrital quartz, small needle-like crystals of authigenic (?) feldspar, magnetite, pyrite, hematite, and limonite. The red color is due to iron oxides, derived from magnetite and pyrite, which fill interstices between carbonate grains and minute fractures.

It is thought that the clastic materials were derived from a soil mantle and deposited in the cavities by carbonate-rich waters.

4. *Arthrophycus* AS A GUIDE FOSSIL IN NORTHERN VIRGINIA.*

Robert S. Young; *Virginia Geological Survey.*

In the course of field investigations in the Edinburg, Virginia-West Virginia quadrangle, "worm trails" identical with *Arthrophycus alleghaniensis* (Harlan) were noted in the Keefer sandstone of middle Niagaran age. Previously recorded occurrences of this form in Virginia and West Virginia have been restricted to the Clinch-Tuscarora sandstone, of Albion age and the Massanutten sandstone, the age of which is uncertain. With the Keefer occurrence, the index value of *Arthrophycus alleghaniensis* is either greatly reduced or completely nullified. It would appear that this form is a facies fossil restricted to the relatively clean sandstones of the Lower and lower Middle Silurian.

On the basis of the known occurrences of *Arthrophycus* in these three formations of very similar lithology, it is suggested that the Massanutten sandstone is the direct eastern equivalent of the Tuscarora and Clinton (Rose Hill and Keefer) of the Great North Mountain section in western Shenandoah County. If this correlation is valid, the Massanutten sandstone occupies the time interval of the Albion and lower Niagaran. This time span also represents the stratigraphic range of *Arthrophycus alleghaniensis.*

5. GEOLOGICAL SECTION ALONG ROANOKE RIVER FROM CLARKSVILLE, VIRGINIA TO ROANOKE RAPIDS, NORTH CAROLINA.

Wilbur A. Nelson; *University of Virginia.*

This geological section is composed of a series of folded pre-Cambrian schists, phyllites, slates, volcanics, gneisses, and granites, dripping almost vertically, and striking slightly east of north, almost at right angles across the Roanoke River. Two post-Paleozoic granite batholiths, or stocks, have been intruded, one at Buggs Island and the other near Roanoke Rapids. Eight thousand feet downstream from Eaton's Ferry, North Carolina, there

* Presented with the permission of the State Geologist of Virginia.

occurs a sequence of rocks which is interpreted as follows. A coarse pre-Cambrian granite, which is considered equivalent to the Lovingston formation, is overlain by a 1000-foot thick thoroughly metamorphosed conglomerate. The conglomerate is considered equivalent to the Rockfish formation, and, in turn, is overlain by a thick series of quartz mica schists with pegmatitic injections. This series is considered equivalent to the Lynchburg formation, and is overlain by a thick series of volcanics correlated with the Swift Run formation. This sequence is repeated to the west in reverse order. The coarse pre-Cambrian granite is considered to occupy the crest of a compressed anticlinal fold.

6. DISPLAY OF GEIGER COUNTERS AND ULTRAVIOLET LAMPS.

Marcellus H. Stow; *Washington and Lee University.*

The following instruments used for the detection of radioactivity were demonstrated:

The model SU-7 Geiger counter manufactured by Tracerlab Corporation.

The model SM-3 Geiger Counter manufactured by El Tronics Company.

The model 600-A Geiger counter manufactured by Minerals Engineering Company.

In addition to the above radiometric instruments, a short-wave and a long-wave ultraviolet lamp in field case, manufactured by Ultra-Violet Products Company, were demonstrated.

7. GEOLOGY OF URANIUM DEPOSITS WITH SPECIAL REFERENCE TO THE GEOLOGY OF VIRGINIA.

Donald L. Everhart; *Atomic Energy Commission.*

The fast-growing science of uranium geology and exploration techniques has reached a stage at which the major types of uranium ore deposits in many parts of North and South America, Europe, Africa, and Australia have been classified and studied in considerable detail. Progress has been made in our understanding of uranium geochemistry.

Twenty-seven distinct types of uranium ore deposits are recognized, of which nine include all the important present producers in the Western World.

The Commonwealth of Virginia is underlain by a number of rock types and contains a number of metalliferous deposits that appear, by our experience to date, to be favorable for uranium deposition. The A.E.C.'s geologic staff is interested in discussing uranium-ore criteria with the geologists and prospectors of Virginia and in co-operating in the examination and evaluation of favorable areas if they warrant it.

Particularly favorable geologic environments include continental conglomerate, arkosic sandstone, or mudstone formations, especially those high in carbonized plant matter, and equivalent metaconglomerate, quartzite, schists, or paragneiss formations. Three hydrothermal deposits which are favorable are: siliceous veins carrying pyrite and galena, siliceous veins rich in titanium, and nickel-cobalt-copper-silver veins.

8. THE MASTER'S DEGREE IN GEOLOGY.

Joseph K. Roberts; *University of Virginia.*

A brief study of requirements for the master's degree in America has brought out several interesting practices in 18 selected institutions of higher learning. The master's degree is the teacher's degree. The training for this degree should be broad and cultural, yet at the same time specific and scientific. The requirements below the graduate level must be the physical and biological sciences. The average master's curriculum involves about 30 hours with or without a thesis. The average time of required residence is one academic session, but the candidate usually takes more time. A degree without a thesis requires more course work. Nearly all the institutions contacted require French or German or some other language which may be used by the student in graduate work. One university even allows ancient language. The master's final examinations may be written and/or oral, and the thesis may call for a defensive examination. No thesis is required at Harvard, Yale, Chicago, or Stanford. The thesis problem may involve field work, and/or laboratory investigation, and/or research in the library. Both M.A. and M.S. degrees are given. Usually the M.A. follows a B.A. and the M.S., a B.S. Most schools of higher learning seem to hold the master's degree in healthy esteem and are inclined somewhat toward the Master of Arts.

9. STUDIES OF STREAM PROFILES IN THE SHENANDOAH VALLEY, VIRGINIA.

John T. Hack; *U. S. Geological Survey.*

Studies made primarily in Augusta County, Virginia, have furnished data that permit an empirical analysis of some of the factors that control the form of the longitudinal profiles of streams. They indicate that channel slope decreases downstream as a function of the increase in length and drainage area. The slope and the rate of decrease in slope, however, are strongly affected by the particle size of material in the stream bed and are also affected by the shape of the channel.

The size of the bed material is determined by several factors including the initial difference in elevation between two points on a stream, the rat of wastage of interstream areas by weathering, and the resistance of the transported material to abrasion and breakage. Most streams originating in the limestone and shale regions exhibit a marked increase in size of material on the bed in a downstream direction. Streams in the Devonian sandstone areas to the west of the limestone floor of the Shenandoah Valley transport very coarse material but show very little change in size of bed material downstream. Some streams which enter the limestone area from the sandstone area to the west show a decrease in the size of bed material downstream from the point of entry.

10. SOIL MINERALOGICAL STUDIES IN THE MIDDLE RIVER BASIN OF VIRGINIA.

Dorothy Carroll; *U. S. Geological Survey.*

The Middle River drains an area of limestone, dolomite, sandstone, and shale in Augusta County, Virginia. Alluvial material along the Middle River and its tributaries has been derived by the erosion of residual soils developed from these rocks. The residual soils may show a well-developed podzolic profile or be skeletal and thin.

The minerals of the insoluble residue of parent rocks were determined microscopically. The limestone contained very few heavy minerals but the shale and sandstone yielded distinctive though restricted suites. Mechanical analysis of the soils was made by the standard pipette method, and the fine and very fine sand was examined microscopically. The soils contain much silt. The pH and the ion-exchange capacity were determined. A partial chemical analysis was made of a Frederick silt loam profile on Lenoir limestone of Middle Ordovician age.

The insoluble minerals of the rocks were found in the soils; the varietal features of zircon and tourmaline were used for identification of the heavy mineral suites. Feldspars were common in some soils. The mineral suites of alluvial soils showed mixed origin except where streams were draining only one rock type. The influence of the sandstone of the Conococheague is recognized by the presence of well-rounded grains and by tourmaline with authigenic outgrowths. The sandstone of the Chemung formation of Devonian age has contributed several varieties of zircon and particolored tourmaline.

11. INVESTIGATION OF ALLUVIAL CLAYS IN THE SHENANDOAH VALLEY.

John C. Hathaway; *U. S. Geological Survey.*

The clay-mineral compositions of several samples of alluvial material and source-area soils of the Middle River drainage basin of the Shenandoah Valley have been determined. Vermiculite-, mica-, and kaolin-type clay minerals occur in variable amounts. Parent material shows less influence on clay-mineral composition than does degree of weathering as suggested by position of the samples in soil profiles.

Vermiculitic clay of a mixed-layer character, possibly interstratified with chlorite and mica layers, seems to increase in importance with weathering. A decrease in hydrous mica usually accompanies the increase in vermiculite. The kaolin minerals exhibit the least change.

12. CLAY MINERALS IN TATUM SILT LOAM SOIL.

C. I. Rich; *Virginia Agricultural Experiment Station.*

Tatum silt loam, a soil developed over Wissahickon schist, was sampled in Fauquier, Louisa, Culpeper, and Fluvanna counties of Virginia. Identification of the clay and claylike minerals was made by x-ray diffraction and differential thermal analysis. The predominant minerals found were kaolinite, illite, and dioctahedral vermiculite. Random interstratification of illite and vermiculite was apparent in samples from some localities. Gibbsite, abundant in the Culpeper sample, was not detected in some samples. Iron oxides make up about 10-20 per cent of the clay-size fraction (less than two microns). Quartz was found in the coarse clay (2-0.2

microns). Although kaolinite and vermiculite were the only clay-type minerals found in the medium and fine clay fractions, iron oxides were also present. These fractions of some samples also contained gibbsite.

The vermiculite differed in its reaction to potassium saturation. In some samples the basal spacing decreased from 14.7 to 10.2 angstroms on potassium saturation; in others the spacing decreased less. Subsoil vermiculite samples tended to collapse on potassium treatment more readily than surface samples. It is proposed that some difficulty exchangeable cation, perhaps aluminum, between the basal planes prevented saturation with potassium. Treatment of the clay fraction for 10 minutes with 1N NH_4F permitted potassium saturation and collapse of the 14.7 line to 10.2 angstroms.

13. SUBSURFACE DRAINAGE ALONG NORTH SIDE OF WALKER MOUNTAIN, VIRGINIA.*

Jean Lowry; *Virginia Geological Survey.*

Some of Virginia's largest and deepest caves occur in Middle Ordovician limestones along the north side of Walker Mountain. In this belt, the known caves contain flowing sterams whereas elsewhere in southwestern Virginia only one cave out of six is likely to have one. Several of the Walker Mountain cave streams appear to flow in a direction opposite to that of nearby surface streams.

Downcutting by surface streams has tapped the network of phreatic cavities, opening them to vadose water which has partially removed the mud fill and deposited beds of cobbles in places. The former watertable level is well-marked in Newberry-Bane Cave at a depth of 315 feet below the entrance where the nature of th cavities shows a striking change. Above this level graded passages and large domestic occur; below, irregular rounded cavities having large cuspate projections from floor, walls, and roof are common.

Cave streams flow like water in a pipe; they may cross over each other without meeting, or may double back under themselves. Underground waterfalls are common, especially in the domepits. Several streams may occur in a single cave. The Walker Mountain caves are ideal for further much-needed study of the behavior of underground water in limestone terrain.

14. FUNDAMENTAL PROBLEMS OF GENESIS OF APPALACHIAN DOLOMITES.

Byron N. Cooper; *Virginia Polytechnic Institute.*

Fundamental problems connected with the formation of Appalachian dolomites of Cambro-Ordovician age are reviewed in the light of ranges in chemical composition of some 235 analyses of various dolomites in the Valley region. Regional facies variations in the Cambro-Ordovician dolomites strongly suggest a northwestern source for the deposits. Median belts of the Canadian series in the Appalachian Valley show very inter-

* Presented with the permission of the State Geologist of Virginia.

esting gradations and alternations of limestone and dolomite, but observed relations of these two lithologies raise more questions about the possible sequence of events during dolomitization than they answer. None of the information obtained up to the present time can be taken to show that primary dolomite is an impossibility. At least some dolomite seems so formed by conversion of previously deposited films of calcium carbonate practically at the sea-sediment interface. The unexpected discovery that the ratio of iron to magnesium in Appalachian dolomites is virtually constant, regardless of type or location of the dolomite suggests the possibility that iron may be an essential element in the particular mineral species characterizing our Appalachian dolomites. Mineralogical and petrographic studies of dolomites, coupled with more and better chemical analyses, should provide many of the answers to the various problems of dolomite genesis.

15. STAINING METHODS FOR DIFFERENTIATING LIMESTONES AND DOLOMITES.

C. R. B. Hobbs, Jr.; *Virginia Polytechnic Institute.*

Preferential staining procedures facilitate the differentiation of calcite from dolomite in magnesium-bearing limestones. Mineral composition and structural relationships are emphasized in relief on stained polished surfaces.

The purpose of this investigation is to determine suitable staining reagents that will permit an accurate determination of composition and structure of magnesium-bearing limestones. Because of a difference in the mineral composition and grain size of the specimens, the reaction time and reagent concentration are not critical. Two unlike specimens treated with reagents of the same concentration for the same length of time will stain with dissimilar intensity. Stains are developed the same way that photographs are developed.

After considering staining techniques described in available literature (ferric chloride, logwood dye, silver nitrate, copper nitrate, cobalt nitrate, and alizarine red), the writer concludes that potassium ferricyanide and a modification of the logwood dye are most satisfactory. Rhodamine B, which is substituted for logwood dye, stains calcite pink; potassium ferricyanide stains dolomite powder blue. Potassium ferricyanide stains dolomite only if iron is present; therefore, in the absence of iron, rhodamine B is used to stain calcite. The malchite green oxalate staining method may be substituted for the rhodamine B procedure.

16. SELECTIVE OBLITERATION OF FOSSILS BY DOLOMITIZATION.

Wayne E. Moore; *Virginia Polytechnic Institute.*

The Suwannee limestone of Florida is composed of beds of limestone, partially dolomitized limestone, and dolomite. The dolomitization of the limestone appears to be a secondary feature of the rock. As a limestone bed in this formation is dolomitized, the fossils are selectively eliminated from the rock by solution and by dolomitization.

Prior to dolomitization those shells that contain appreciable amounts of aragonite are dissolved from the rock by ground water. *Pecten, Ostrea,* Foraminifera, and echinoids are not removed by solution. As dolomitization takes place, scattered rhombs of dolomite develop in the rock and in the shells of the fossils not previously removed by solution. These rhombs of dolomite replace the calcite of the shell walls and destroy the organic structure of the shell. Foraminifera are among the first and echinoids are among the last to be dolomitized. Where dolomitization of this type occurs, the finer sedimentary structures of the rock are destroyed, and no evidence remains to indicate that the rock was once fossiliferous.

17. PRE-LITHIFICATION FEATURES OF SOME CAMBRO-ORDOVICIAN MAGNESIAN AND DOLOMITIC LIMESTONES OF SOUTHWESTERN VIRGINIA.

W. D. Lowry; *Virginia Polytechnic Institute.*

Primary and other pre-lithification features include bedding, cross-bedding, ripplemarks, fossils, siliceous layers and nodules, stylolites, and slump faults. Excluded are fracture fillings of silica with dolomolds and mineralization along major faults. Primary features of the completely dolomitized Knox limestones are generally not well preserved and the only fossils are silicified.

The partial dolomitization of Chepultepec limestone in the Virginia Polytechnic Institute quarry near Blacksburg occurred after slumping but before lithification. The surfaces of slump faults are stylolites developed as solution permitted the walls to interlock. These stylolites and numerous ones along the bedding consist of grains of pyrite and aggregates of relatively coarse-grained dolomite. The sutured texture of these aggregates is characteristic of the dolomitic limestones and largely the result of interference during growth. Pressure solution at grain contacts may complete suturing and destroy permeability. Dolomitization, although not primary, may proceed so long as permeability exists and may not be interrupted until lithification is nearly complete. Incomplete dolomitization of Chepultepec and Longview limestones is attributed to originally low permeability. Partial dolomitization might result from expulsion of poor water, but complete dolomitization requires circulating magnesium-bearing solutions. A reducing environment may favor formation of pyrite and dolomite while calcite is being dissolved.

18. POSSIBLE TRACE-ELEMENT AND/OR ISOTOPE CONTROL OF DOLOMITE FORMATION.

R. V. Dietrich; *Virginia Polytechnic Institute.*

All elements recorded to be present in dolomites and in natural solutions generally believed to be representative of the solutions from which dolomite may have been precipitatd are listed. The known natural isotopes of each of these elements are reviewed.

It is emphasized that formation of dolomite, whether it be by precipitation or by replacement (either volumetric or molecular), must be in accordance with the laws of physical chemistry. It is suggested that relatively

minor upset(s) of elemental and/or isotopic abundances within the solutions from which the dolomite was derived may have promoted its formation.

A number of questions are posed with the hope that they may initiate investigations that will lead to understanding of the mode(s) of dolomite formation. Representative questions are: 1. Can precipitation of dolomite be controlled by amount(s) of some trace element(s), *e.g.*, strontium, in the solutions from which the dolomite was deposited? 2. Can the formation of dolomite be promoted by a relative concentration of some isotope(s), *e.g.*, a concentration of deuterium (as D_2O and/or HDO) such as is known to occur locally (because of selective evaporation) in environments believed to be similar to those in which at least some dolomite has been formed in the past?

19. DEPOSITION OF CALCITE AND ARAGONITE IN CAVES.

John W. Murray; *Virginia Polytechnic Institute.*

Cave deposits, such as stalactites, stalagmites, and helictites are commonly composed of calcite and less commonly of aragonite, two of the polymorphic forms of calcium carbonate. This investigation was undertaken to determine what factors control the identity of the mineral deposited.

Chemical analyses were made of numerous samples of water dripping from stalactites of each of these minerals and of samples of the deposits themselves. All samples were taken from Canoe and New River caves, Giles County, Virginia.

In one laboratory experiment, calcium carbonate was precipitated in test tubes by allowing carbon dioxide to escape from solutions of calcium bicarbonate to which various salts had been added. In another experiment stalactites were grown under controlled conditions and the effect of composition of the water on the minerals formed was studied.

From these experiments, it may be concluded that the presence of sufficient magnesium, strontium, or lead favors the formation of aragonite as does high temperature and low concentration of calcium bicarbonate. These factors may be influenced by physical conditions such as rate of flow of water onto the surface, area of the surface, and relative humidity. Concentration of magnesium sems to be the factor most likely to be effective in controlling the mineralogical identity of the calcium carbonate of cave deposits.

20. GEOLOGY OF THE AUSTINVILLE DISTRICT, VIRGINIA.

W. Horatio Brown; *New Jersey Zinc Co., Bertha Mineral Division.*

Austinville, which in early days was known as "The Lead Mine," may be aptly described as "The Arsenal of Virginia." It has supplied lead for our armies in every war the country has fought, starting with the French and Indian War. It is regarded by the writer as the most historic town west of the Blue Ridge in Virginia. It has been the capitol of the North-

west territory, the site of the signing of the first Declaration of Independence and the target of enemy action in three wars.

The Austinville Mine, to which the town owes its being, was operated on residual lead ore in clay in the early days. In recent years the mine has been operating on sulphide ores of zinc and lead which occur in brecciated Shady Dolomite. These breccia ore bodies occur parallel with strike faults and are enlarged at cross-fault intersections. They are regarded as being of low temperature magmatic origin.

21. ELECTRICAL RESISTIVITY AND MAGNETIC SURVEY OF THE BUSH-HUTCHINS ILMENITE DEPOSIT, VINTON, VIRGINIA.

Charles E. Sears, Jr.; *Virginia Polytechnic Institute.*

The Bush-Hutchins ilmenite deposit is near the junction of State Highways 24 and 654, approximately 1.8 miles east of Vinton in Roanoke County, Virginia.

Geophysical work (a magnetometer survey) was first done in this area by the Division of Geophysical Exploration of the U. S. Bureau of Mines in 1946. The results of the survey were published in U. S. Bur. Mines Rept. Inv. 4112, August 1947. The present report gives the results of an electrical resistivity and Hotchkiss Super-dip survey made during the spring of 1954 under the supervision of the writer.

Electrical resistivity and magnetic anomalies were obtained along the strike of the investigated deposit. The results of the geophysical work thus far completed point to tabular bodies which strike approximately N. 50° E. and dip steeply to the northwest. Further work is necessary to outline the limits of these bodies along the strike and down the dip.

22. A PREVIEW OF RECENT LITERATURE ON THE GEOLOGY AND ORIGIN OF PEGMATITES.*

Arthur A. Pegau; *Virginia Geological Survey.*

Theories which concern pegmatites and which are based on studies made during the past few years may be classified into three categories: zonation, emplacement, and replacement. Increasing emphasis has been placed on the zoning or structure of pegmatites. This zonation is three dimensional and extends from the outside to the center of the pegmatite body. An outer zone, an intermediate zone, and a medial zone or core are generally recognized.

Recently structural control of the emplacement of pegmatites has received considerable attention. The structural features in igneous rocks that control the emplacement of pegmatites include primary layering and other planar structures. The features in metamorphic rocks that control emplacement include bedding, foliation and schistosity. Fractures in both kinds of rock may control emplacement. Although replacement in pegmatite bodies has been recognized as important for many years, it has been given much greater emphasis in recent years.

* Presented with the permission of the State Geologist of Virginia.

Current theories regarding the origin of pegmatites do not differ greatly from those held for the past twenty years. This is surprising in view of the fact that the theories advanced for the origin of some plutonic rocks have undergone such material changes in the past ten years. In other words, most writers still consider that pegmatites are essentially of magmatic origin rather than a product of metasomatic replacement.

23. EXPLORATORY DRILLING ON THE EASTERN SHORE PENINSULA, VIRGINIA.

G. C. Tibbitts, Jr.; *U. S. Geological Survey.*

In the summer of 1953, four test wells were drilled by the hydraulic rotary method on the Eastern Shore peninsula. These wells are on a 55-mile line extending north-northeast from Capeville, on the southern tip of the peninsula, to Oak Hall near the Maryland boundary. Their depths are 470, 100, 450 and 451 feet; three wells penetrate the Middle Miocene.

Samples were collected at 5-foot intervals, and Schlumberger electric logs were run in each hole. The electric, lithologic, and driller's logs show a remarkable correlation between the wells.

All drill cuttings were washed in a 150-mesh screen, floated in carbon tetrachloride, and the floats sent to the U. S. National Museum for foraminiferal studies. According to Miss Ruth Todd of the Museum, the wells penetrate the Miocene at 65, 90, 125, and 115 feet from south to north. Only one well contained a Pleistocene fauna. That fauna is characteristic of a cold water environment similar to that found today from New England to the Arctic. The Miocene assemblages are typical of a shallow marine environment open to ocean currents.

Good water-bearing zones were encountered above 200 feet. Below this depth, ground water occurs only in thin aquifers of relatively low yield and it is likely to be too highly mineralized for ordinary uses.

24. HEAVY MINERALS OF SOME YORKTOWN SEDIMENTS OF VIRGINIA.

Albert J. Perry, David W. McGain, and J. Scott Laurent; *Washington and Lee University.*

Microscopic study of heavy mineral separates of samples collected from seven sections of the Yorktown formation of Miocene age on the York and James Rivers showed striking similarity in the minerals present and their relative abundance. Correlation of these sections was possible by a combined lithologic and heavy mineral study. The sediments were determined to have been derived from crystalline rocks, and the sources of the sediments and their conditions of deposition were found to be the same throughout.

25. MINERAL STUDIES OF THE PRODUCT OF SOME VIRGINIA QUARRIES.

Eugene B. Sieminski, Bertram S. Griffith, Jr., and Mahlon D. Woodring; *Washington and Lee University.*

Samples of screenings from seven quarries in granitic rocks of the Vir-

ginia Piedmont were collected for mineral studies. These were examined to determine the percentages of heavy minerals, light minerals, quartz, and feldspars. The study indicates that the feldspar content of these granitic rocks is appreciably higher than the feldspar content found in quartzites which may have a false appearance of being granitic. These determinations may be important in classifying the rocks of quarries for tax amortization purposes.

26. FUNDAMENTALS OF CRUSTAL MEGASHEARING AND NOTES ON THE FOUR TYPES OF MEGASHEARS IN VIRGINIA.

B. Ashton Keith; Director; *The Institute of Sciences.*

These investigations, which have begun to attract international attention, are based upon certain discoveries made in the 1850's by G. A. Daubree. Daubree's laboratory tests on the effects of various force-sets in the shearing of rocks and various other substances established knowledge that now is used in all schools of engineering. Attention is called especially to Daubree's discovery that many shear zones really consist of a series of roughly aligned minor distortions that are diverse in form or orientation or both. He also found that when rocks and minerals are subjected to excessive torsional stress, two sets or systems of fractures are formed and that the fractures of one set form angles of approximately ninety degrees to the fractures of the other set. Daubree applied his findings to the investigation of similar structures in nature such as joints and cleavage. He also identified "giant joints", which he believed cause the right-angle bends in many large rivers and in some places exert noticeable influence upon other elements of topography. Hartmann and others confirmed Daubree's findings, and Becker and others submitted them to mathematical treatment.

In 1903 my investigations began with discovery of a long aligned arrangement of deep-seated structures. Investigations were made of the important effects of non-parallel, non-coplanar force-sets which have been found to affect the earth's crustal shell. This paper names the classes and systems of megashears, describes their component segments, and demonstrates examples of each of the types that have been found in this region.

27. WHAT IS THE BEHAVIOR OF MAJOR APPALACHIAN OVERTHRUSTS AT DEPTH?*

Ralph L. Miller; *U. S. Geological Survey.*

Recent geologic studies in Lee and Scott Counties of southwestern Virginia revealed interrelations of several major overthrust faults and numerous minor surface and near-surface faults. Projecting the faults downward involves much speculation and raises fundamental questions concerning the mechanics of deformation in this region. These questions are: 1. Do the major thrusts continue downward and transect the basement rocks not far southeast of their traces or do the major faults merge above

* Publication authorized by the Director, U. S. Geological Survey; paper not presented at meeting.

the basement rocks and continue above the basement for many miles southeast of their surface locations? 2. In general, were the southeastern major overthrusts formed first and followed by a wave of compression and thrusting that progressed northwestward or did one or a few major sheets of super-basement rocks move as units along nearly flat thrust planes early in the orogeny, and then become ruptured by additional large and small faults as deformation progressed?

Although the solution to these basic questions may be attained only by deep drilling in critical locations, geophyscial methods might give partial answers. An airborne magnetic survey of this region is being made by the U. S. Geological Survey, and evidence may be obtained regarding the configuration and position of the top of the basement rocks.

28. AN OCCURRENCE OF ZEOLITES IN FAIRFAX COUNTY, VIRGINIA.*

William T. Parrott; *Virginia Department of Highways.*

An uncommon assemblage of zeolites was exposed in a cavity in the diabase of the Fairfax Stone Co. quarry as a result of blasting during the summer of 1953. The quarry is on the east side of State Highway 211, about 1.5 miles south of Centreville, Virginia.

Specimens were collected by both the Geological Survey and the U. S. National Museum. The quarry owner, Mr. Charles Luck, presented the writer with specimens. These were identified by the Geological Survey as the following zeolites:

Thaumasite	$CaSiO_3$. $CaCO_3$. $CaSO_4$. 15 H_2O. hexagonal
Prehnite	$H_2Ca_2Al_2(SiO_4)_3$, orthorhombic
Natrolite	$Na_2Al_2Si_3O_{10}$. $2H_2O$, orthorhombic

The fibrous natrolite and large crystals of thaumasite were on a mass of prehnite.

So far as the writer can ascertain, the occurrence of thaumasite in Virginia has been mentioned only once in the literature.

BUSINESS MEETING

At the close of the technical session, which was attended by about sixty geologists, it was moved and passed that those members who wish to have their abstracts included in "Geological Abstracts", published by the American Geological Institute, should so inform the Section Editor. Discussion of the type of program that should be presented at the annual meeting of the Section showed a wide divergence of opinion.

The nominating committee placed the following names in nomination for section offices. All were unanimously elected.

Chairman——William T. Harnsberger
Vice-Chairman——William T. Parrott
Secretary——Marcellus H. Stow
Section Editor——W. D. Lowry

The meeting was adjourned at 5:00 P.M.

* Paper not presented at meeting.

FIELD TRIP

A caravan of seventeen cars with fifty-three geologists left the Rivanna River Bridge at 8:00 A.M. on May 8, 1954, under the leadership of Joseph K. Roberts and Raymond S. Edmundson. The purpose of the trip was to study areas of Triassic rocks in northern Virginia. The itinerary included Triassic lowlands north of Orange, diabase monadnocks in the vicinity of Cedar Mountains, red sandstone and fresh-water oolitic limestone in the State Highway quarry near Winston, and the large diabase quarry of the Fairfax Stone Company near Centreville. Various zeolites and associated minerals were collected at the Fairfax Stone quarry. The next stop was at the Goose Creek quarry, near Herndon, where exposures of gabbro and diabase were examined. At another quarry in the same vicinity along State Highway 7, rocks of undetermined origin were inspected. The final stop was made north of Leesburg at a grand exposure of the famous "Potomac Marble," a Triassic limestone-conglomerate.

At this point most of the members of the group left for their respective communities after a most enjoyable day in the field under most competent and congenial guidance.

MINUTES OF THE SECTION OF MEDICAL SCIENCES [9]

D. R. H. GOURLEY, *Chairman*
SIDNEY SOLOMON, *Secretary*
EBBE C. HOFF, *Section Editor* (1955)

FRIDAY, MAY 7, 1954—9:00 A.M.—MEDICAL SCHOOL AUDITORIUM

1. MOTION PICTURES SHOWING NERVE GROWTH AND OTHER CELL ACTIVITIES IN TISSUE CULTURES OF RETINA AND BRAIN FROM FROG AND RAT.

C. C. Speidel; *Department of Anatomy, University of Virginia Medical School.*

These pictures of frog and rat tissues show all movements accelerated 128 times. Among the features illustrated are the following: growth of nerve fibers from ganglion cells of the retina and from nerve cells of the brain; progressive injury of rod cells characterized by transverse fragmentation (striation) and curling of the rods; movements of other cells of the retina; and the behavior of various cells of the brain of both nervous and neuroglial types. A case of mitosis and rapid post-mitotic differentiation of an oligodendrocyte is shown.

Several cine-photomicrographs illustrating the behavior of cells *in vivo* are also presented. They make interesting comparisons with some of the *in vitro* pictures. Thus, the growing nerve fibers of retina and brain in tissue cultures are quite like similar regenerating fibers from the proximal stumps of cut vagus and spinal nerves in the living tadpole's tail; the oligodendrocytes of the rat's brain are much like the neurilemma sheath cells of the peripheral nerves in living tadpoles; and certain of the microglia cells (cells of Hortega) of the rat's brain in cultures resemble the macrophages in the living tadpole's tail.

2. ON THE PRESENCE OF ARGENTOPHILIC CELLS IN THE HUMAN ADENOHYPOPHYSIS.

William M. Shanklin; *Medical College of Virginia.*

Cells having argentophilic properties were observed in the human adenohypophysis in sections stained for pituicytes by a Hortega silver carbonate method.

This study includes 84 consecutive pituitaries varying from the newborn to 9 lyears. All, except 16, had argentophilic cells. Ten of the negative specimens were newborn and six adult. One newborn and one six-month specimen were positive. Examination of Masson trichrome stained sections showed marked degeneration of the epithelium in three

of the pituitaries lacking argentophilic cells. Their absence in the remaining three can be attributed to overformalinization.

Argentophilic cells occurred most abundantly in the pars anterior, in some areas constituting about 30% of the total cell count, to a lesser degree in the lower pars tuberalis and in pars intermedia. The argentophilic cells were very darkly stained and stood out in sharp contrast to the unstained chromophobe and chromophil cells. They were located inside the cords of epithelial cells, and many had broad protoplasmic processes that extended to the periphery of the cord.

It has not been determined whether these cells represent the acidophils, basophils, chromophobes, or a new variety of cell.

3. EFFECT OF HORMONES ON SERUM PROTEIN PATTERNS.

Cornelia Hoch-Ligeti and Karen Irvine; *University of Virginia School of Medicine.*

Attempts were made to find the pathway leading to the changes in the serum protein composition which were observed in patients undergoing surgical operations. The serum proteins were analyzed by paper strip electrophoresis. During the first four post-operative days a consistent decrease in the relative concentration of albumin and an increase in the relative concentrations of alpha$_1$ and alpha$_2$ globulins were found. In rats similar changes in the serum protein patterns were observed after abdominal incision. Hormones and drugs acting on the autonomous nervous system were tested in rats for their effect on the serum proteins. The only substance which was found to produce an alteration in the protein pattern similar to that found post-operatively was the adreno-corticotrophic hormone (ACTH) of the pituitary. Since both cortisone and desoxycorticosterone were ineffective after short term administration, it appears that ACTH influences the serum protein composition through a substance other than the adrenal cortical hormones thus far tested.

4. CHEMICAL AND ULTRACENTRIFUGAL LIPID ANALYSIS OF DIABETIC AND CARDIAC SERA.

D. F. Koenig, P. D. Camp, W. R. Jordan, J. C. Forbes, C. J. Likes; *Virginia Institute for Scientific Research and Medical College of Virginia.*

A technique of analysing sera for free and loosely-bound cholesterol, and the Gofman ultracentrifugal procedure for lipoprotein analysis, are briefly described. Results of combined studies of "readily-extractable" cholesterol and various lipoprotein fractions, in diabetic and cardiac sera, are discussed.

5. THE ROLE OF THE ADRENAL GLANDS IN THE SUPPORT OF ARTERIAL BLOOD PRESSURE IN DOGS AND CATS FOLLOWING EXTENSIVE SURGERY.

E. D. Brand; *University of Virginia School of Medicine.*

Following extensive surgery the arterial blood pressure of 18 dogs and

5 cats ranged from 70 to 125 mm Hg. Clamping of the blood supply to one adrenal gland was without consistent effect, but when the pedicle of the remaining adrenal was clamped the arterial pressure fell precipitously to a new level ranging from 35 to 100 mm Hg, and remained at this level or dropped slowly until the death of the animal. If one or both clamps were removed however, there was a rapid rise in blood pressure of from 20 to 120 mm Hg with a subsequent leveling off at or somewhat below the reading present prior to the clamping. This effect was blocked by the administration of the adrenolytic agent dibenzyline (2-4 mg./kg. i.v.). Control clamping of the spleen, kidneys, or of the vena cava distal to the adrenal veins was without effect on the arterial blood pressure as was administration of cortisone or hydrocortisone (12.5 mg./kg., i.v.).

6. A THEORY OF THYROXINE ACTION.

Chalmers L. Gemmill; *University of Virginia School of Medicine.*

A study of the ultraviolet spectra of thyroxine and related compounds has shown that the presence of iodine causes a marked increase in the height of the bands and a movement of the maxima towards longer wave lengths. This change has been interpreted by Dr. C. Reid (Present address: Department of Chemistry, University of British Columbia, Vancouver, Canada) as a $n - \pi$ transition in which an electron under the excitation of ultraviolet radiation leaves the normal (n) state and enters the π state. This transition is aided by the presence of the heavy atoms of iodine. If a similar transition may occur under chemical activation, the electron may then pass through the whole molecule and be delivered to an electron acceptor situated at the amino acid end of the molecule. Although other theories may be presented to explain these changes in the ultraviolet spectrum, this idea has the possibility of explaining the need for certain specific parts of the thyroxine molecule essential for biological activity and for prediction of compounds of possible biological action related to thyroxine.

7. EFFECT OF ALCOHOL INTOXICATION AND ACTH ON LIVER ASCORBIC ACID IN THE GUINEA PIG.

J. C. Forbes and G. M. Duncan; *Medical College of Virginia, and the Division of Alcohol Studies and Rehabilitation, Department of Health, State of Virginia.*

Earlier work has shown that although alcohol intoxication in guinea pigs caused a marked drop in the ascorbic acid content of the adrenal glands, repeated intoxication did not lead to any acceleration of the rate of development of scurvy when the animals were on a scorbutogenic diet. It thus appeared that this particular stressor agent, at least, did not increase or accelerate the utilization of ascorbic acid by the guinea pig. In order to determine whether stress had affected the distribution of vitamin C in any other tissue in addition to the adrenals, a study was made of the content of ascorbic acid in the liver of guinea pigs at intervals for several

days following alcohol or ACTH administration. The experimental results showed that the ascorbic acid content of the liver of those animals sacrificed 24 hours after alcohol intoxication did not demonstrably differ from that of the corresponding control animals. However, 48 hours after the alcohol administration, the test animals showed a significantly higher liver ascorbic acid content than the controls. The difference 72 hours after alcohol was less but still notable. Quite comparable results were obtained with injection of adrenocorticotropic hormone, although the difference between the test and control animals developed about 24 hours earlier. The results suggest that mobilization of ascorbic acid to the liver may be a part of the adaptation process.

8. BLOOD AND URINARY CHANGES DURING ACUTE ALCOHOL INTOXICATION IN DOGS.[1]

Gerda Klingman, Ruby Bane, Harry Bachman and Harvey B. Haag; *Medical College of Virginia.*

This investigation concerns the changes in blood electrolytes, pH, bicarbonate, glucose, hematocrit, hemoglobin, NPN, BUN, alcohol levels and urinary pH, electrolytes and volume when fatal or near fatal doses of alcohol were administrated orally to dogs. Unanesthetized dogs were given 25% alcohol (12 mg. 95% alcohol/Kg. to body weight) in three equal hourly dosages. For control purposes, two weeks previously the same animals received the equivalent volume of water similarly administered and the same studies done. The controls showed the expected diuresis and lowered urinary milliequivalents of K^+, Na^+, Cl^-. Plasma Na^+ and Cl^- showed slight variations, plasma K^+, hematocrit, hemoglobin, NPN and BUN decreased. When these animals received alcohol they showed a transient, slight diuresis, then a marked oliguria. The urine became more acid; Na^+ decreased more suddenly and markedly; Cl^- behaved essentially similar to the controls. The blood glucose, NPN, BUN, hematocrit, and hemoglobin increased; the blood pH and the plasma K^+, Cl^- and Na^+ decreased. Animals living less than 12 hours after administration of alcohol died usually of respiratory failure; longer living animals died usually of circulatory failure. The most striking effects of severe acute alcoholism in dogs is acidosis, hyperglycemia, hemoconcentration, oliguria, and elevated plasma NPN and BUN.

9. SEDATIVE-HYPNOTIC PROPERTIES OF 2-ETHYLCROTONYLUREA.

Merle H. Pindell,[2] Otis E. Fancher and Robert K. S. Lim; *Miles-Ames Research Lab., Elkhart, Ind.*

MA-110 (2-ethylcrotonylurea) is an almost insoluble, white crystalline compound prepared by dyhydrobromination of Carbromal. Homogenized aqueous suspensions were therefore employed for administration. MA-

[1] This work was done under a research grant from the Division of Alcohol Studies and Rehabilitation; Department of Health of the State of Virginia.

[2] Present Address: Dept. of Pharmacology, Medical College of Virginia, Richmond, Va.

110 has an oral LD_{50} of 2500 mg/kg in rats, 3500 mg/kg in dogs, and an intraperitoneal LD_{50} of 900 mg/kg in dogs, 1100 mg/kg in guinea pigs, and 1400 mg/kg in rabbits. Rats become sedated at extremely low oral doses (1% LD_{50}). Sedation occurs in 15-30 minutes and lasts several hours. At any dose up to about 48% LD_{50} the rats are readily arousable and when aroused seem normally active. With still higher doses nervous depression (subhypnosis) progresses until hypnosis is complete at about 90% LD_{50}. Under similar conditions pentobarbital, seconal, and phenobarbital produce sedation at about 4% LD_{50}. Barbiturate sedation appears earlier but subsides faster than MA-110 sedation. Increasing this dosage to only 16% LD_{50} produces a more profound state of depression (subhypnosis) and with doses of 35% (pentobarbital, second) and 50% (phenobarbital) hypnosis occurs. The wide range of dosage between sedation and hypnosis shown by MA-110 suggests a much greater margin of safety than with existing sedatives. Caffeine (60 mg/kg, IP) given before or after MA-110 (100-250 mg/kg, IP) does not alter its sedative effect. MA-100 produces no slowing of respiration beyond that seen in sleep and no effect on blood pressure with doses up to 80% LD_{50} (IP) in unanesthetized dogs. It has no anticonvulsant, analgetic, or antispasmodic activity. The low sedative dose, wide sedative range, and low toxicity of MA-100 render it unique among sedatives.

10. SACRO-COCCYGEAL TUMOR.

James E. Kindred; *University of Virginia Medical School.*

The morphologic and histochemical characteristics of the tissues of a tumor from the sacrococcygeal region of a five-day old child which was removed by Dr. Shannon Allen of the Surgical Service is described, and suggestions are made as to its etiology. The tumor lay between the rectum and the coccyx, pushed the anus and rectum forward, and had a distended volume of about 200 cc. The stroma is of the usual tissues found in the ano-coccygeal region and envelops two large cysts each lined with abortive neuroglia tissue and ependyma. Several smaller cysts lined with varying kinds of stratified squamous epithelium mingled in some of them with PAS positive goblet cells are present. The epithelium is like that of the normal anal canal in part. Tentatively, it is suggested that the tumor is derived from overgrowth of cysts arising from the coccygeal vestige of the neural tube and from the epithelium of several zones of the anal canal.

11. THE USE OF A PERSISTENT SCREEN OSCILLOSCOPE FOR THE ACCURATE MEASUREMENT OF SEIZURE THRESHOLD IN RATS.

Cary G. Suter, Guy H. Heye, Jr., Thomas H. Simmons, Jr.; *University of Virginia Hospital, Charlottesville.*

12. STUDIES ON PANCREATIC TRANS-MEMBRANE POTENTIALS.

S. Solomon; *Medical College of Virginia.*

A microelectrode method has been described by which electrical potentials of pancreatic tissue may be determined. If animals are fed, the potential values in the absorbtive state have either a positive or a negative sign. With 12-16 hour starved animals, the inside of the tissue is found only to be positive to the outside. If the animals be excessively starved, however, the potential sign is reversed and the inside is found to be negative. Application of pilocarpine to the gland usually results in a fall in potential difference. Treatment of fed animals of negative potential signs with acetylocholin produces a rise in potential towards zero.

13. EFFECT OF ADENOSINE TRIPHOSPHATE, MAGNESIUM AND CALCIUM ON THE PHOSPHATE UPTAKE BY RABBIT ERYTHROCYTES.

H. Jones; *University of Virginia School of Medicine.*

During the course of a series of studies on the influence of adenosine triphosphate (ATP) on the uptake of radioactive orthophosphate (P^{32}) by rabbit erythrocytes, it was found that calcium and magnesium had an effect on the uptake in the presence of ATP. The results of incubating blood with Ca^{++} with and without ATP showed distinct inhibition by the cation. When incubating blood with 3.9×10^{-6} M Mg^{++} and 4.7×10^{-6} M $HPO_4^=$ and with a series of ATP concentrations ranging from 1.5×10^{-16} M to 3.4×10^{-3} M the P^{32} uptake was stimulated when the ATP concentration was less than 10^{-10} M. Inhibition resulted as the ATP concentration was increased. This inhibition was strongest at 10^{-7} M ATP. However a second stimulation was observed when the ATP concentration exceeded 4×10^{-6} M. A study of the dissociation and solubility constants in biological fluids of $MgHPO_4$ and MgATP suggests that ATP favors the uptake of P^{32} when all ATP is complexed with Mg in the presence of an excess of either free ATP $=$ or Mg^{++}. At concentrations unfavorable for this combination the P^{32} uptake was reduced, when it could be calculated that undissociated $MgHPO_4$ may exist in the extracellular fluid. This assumption was tested by incubating blood with 1.0×10^{-14} M ATP, 4.0×10^{-6} M $HP^{32}O_4$ and with a series of Mg^{++} concentrations ranging from 3.3×10^{-18} M to 3.3×10^{-6} M. It was found that the P^{32} uptake was stimulated when the Mg^{++} concentration was less than 4×10^{-13} M, but inhibition existed at all higher concentrations of Mg^{++}. This inhibition seemed to be reversable by K^+. A consideration of the appropriate dissociation and solubility constants for Mg induced inhibition suggests that Mg^{++} favors P^{32} uptake if almost all the Mg is complexed with ATP in the presence of free ATP $=$. However, inhibition seemed to be correlated with an excess of Mg^{++} over ATP and with the formation of undissociated $MgHPO_4$. There is evidence for the conclusion that the ATP-Mg complex, where ATP : Mg = 1, acts as the active component of an (ATP $\leftrightharpoons$ ADP) — Mg — kinase — cell surface lipoprotein unit for hexose phosphorylation on the erythrocyte surface.

14. POTASSIUM ADSORPTION BY EPITHELIAL CELLS OF ISOLATED FROG SKIN.

E. G. Huf and J. P. Wills; *Medical College of Virginia.*

It appears that intracellular potassium (K_i^+) in epithelial cells of frog skin is in a state of adsorption since the amount of K_i^+/gm of intracellular water, as a function of the extracellular (equilibrium) concentration of potassium (K_e^+) which was varied over a wide range from 0.1 – 20 μEq/ml, follows rather closely the equation $[K_i^+] = 10^b \cdot [K_e^+]^{1-a}$. One recognizes this as a special form of Freundlich's general adsorption isotherm. Numerical values for the constants a and b can easily be obtained graphically. The K^+ isotherms may then be plotted. The experimental data fall reasonably close to the theoretical isotherms. Three different K^+ isotherms for 3 different Na_e^+ levels were established for: $Na_e^+ = 48$; 120; 168 μEq/ml. All values for a were smaller than 1. They decreased with increasing Na_e^+. Values for b were between 2 and 3 and increased with increasing Na_e^+. The dependence of the constants a and b, in the K^+ -isotherms, upon Na_e^+ may be interpreted as an enhancing effect of Na_e on the adsorption of K_i^+. All experiments were carried out on isolated pieces of skin which were equilibrated for 8 hours at 25° C. in saline solutions containing varying amounts of NaCl and KCl. The pH of the solutions was kept at about 7.4.

15. INHIBITION OF *in vitro* HEME SYNTHESIS FROM N^{15}-GLYCINE BY 2.5-DIMETHYLBENZIMIDAZOLE, 5,6-DIAMETHYLBENZIMIDAZOLE AND RELATED COMPOUNDS.

Lynn D. Abbott, Jr. and Mary J. Dodson; *Medical College of Virginia.*

Chicken erythrocytes provide a biological test system which continues to make hemoglobin when incubated outside the body. The synthesis can be detected and measured by using N^{15}-glycine from which heavy nitrogen is incorporated into the protoporphyrin of hemoglobin which can be isolated as N^{15}-labeled hemin after incubation.

5,6-Dimethylbenzimidazole is a part of the vitamin B_{12} molecule. The benzimidazoles are also structurally related to the purines. Using chicken erythrocytes as described [see also Va. J. Science, 3, 346 (1952)] we have studied the effect of various alkyl-substituted benzimidazoles on heme synthesis.

2,5-Dimethylbenzimidazole, 5,6-dimethylbenzimidazole and 2-ethyl-5-methylbenzimidazole prevented incorporation of N^{15} from N^{15}-glycine into heme by chicken erythrocytes during *in vitro* incubation. Benzimidazole and 2-methylbenzimidazole had slight, but not comparable, inhibitory actino. 5-Methylbenzimidazole had an inhibitory effect intermediate between that of benzimidazole and 2,5-dimethylbenzimidazole. 2-Ethyl-5-methylbenzimidazole was the most potent of all. These are precisely in the same relative order as was found recently by Tamm, et al. for influenza virus inhibition.

The striking coincidence of the relative inhibitory activities of the substituted benzimidazoles for two widely different systems, *in vitro* hemo- us that some very fundamental mechanism underlying both processes is glob'n synthesis by avian erythrocytes and virus duplication, indicates to us that some very fundamental mechanism underlying both processes is involved. This might be the result of selective inhibition of a basic step in biosynthetic mechanisms in which nucleic acid (or nucleoprotein) plays some very important role.

16. *In Vitro* MEASUREMENT OF POTASSIUM TURNOVER IN RAT SKELETAL MUSCLE.

D. R. H. Gourley; *University of Virginia Medical School.*

As part of an *in vitro* study of the metabolism of the intact extensor digitorum longus muscle of the rat (Virginia Journ. Science, 4 : 269 : 1953) the uptake and turnover of potassium by this tissue has been investigated. When incubated in glucose-Ringer solution at 30° C. and equilibrated with oxygen, the extensor muscle maintained 95% or more of its initial potassium content over a 4-hour period. Under these conditions, therefore, the quantities of potassium ions moving into, and out of, the tissue per unit time are approximately equal. Using radioactive potassium, it was found that the turnover rate of potassium ions was $1.36 \pm 0.15\%$ of the tissue potassium per min. The turnover rate showed no great variation over a period of three hours, and there was no significant difference in the potassium turnover rate of opposite muscles from the same animal. Control conditions are therefore established for investigating the effect of hormones on potassium metabolism in skeletal muscle.

17. A SIMPLIFIED METHOD FOR THE DETERMINATION OF AZO DYE IN TISSUE.

J. D. Spain and C. C. Clayton; *Medical College of Virginia.*

One of the criteria of carcinogenic potency of azo dyes is the extent of protein binding of these dyes or their metabolites. Available methods for determination of protein bound dyes are too time-consuming for routine analysis. A method is described for total tissue azo dye which employs alkaline digestion, acidification, filtration and colorimetric measurement of the dye. A blank on the same sample is determined after reduction with stannous chloride. The difference in the two readings is a measure of the units of dye in the sample. The results obtained by

this method for total azo dye parallel those obtained by others for bound azo dye with respect to effect of dietary riboflavin and time of feeding of the dye. Modifications of the method can be used for determination of azo dyes in feces, urine, and diets.

18. INFLUENCE OF CORTISONE ON THE MORTALITY OF X-IRRADIATED ADRENALECTOMIZED MICE.

George A. Stantisteban; *Medical College of Virginia;* J. Z. Bowers and Thomas F. Dougherty; *Departments of Radiobiology and Anatomy, University of Utah.*

The differences in mortality between X-irradiated adrenalectomized non hormone-treated CBA mice and those given daily intraperitoneal injections of graded doses of cortisone (.005, .05, .5, 1 mg/day) were compared by making standard statistical tests on final mortality, and on slopes of the cumulative mortality curves as fitted by the method of least squares.

The final and cumulative mortality of mice adrenalectomized after receiving 650r total body X-irradiation was significantly greater than that of the intact irradiated and adrenalectomized non-irradiated controls. Cortisone replacement therapy failed to fully restore the radio-resistance of adrenalectomized animals. However, statistical analysis of the fitted curves disclosed that the hormone progressively decreased the slopes, increased the mean survival time and delayed the death times (any per cent level) and day of mean death frequency as the dosage was increased. These relationships were statistically significant.

Comparisons of the slopes of the mortality curves suggest that the increased mortality in the experimental animals was associated primarily with an adrenal cortical insufficiency. The presence of the adrenal cortical secretions thus seems to be essential for the resistance to X-irradiation injury. Cortisone, however, may partially restore radio-resistance in the event of an adrenal cortical insufficiency associated with X-irradiation.

19. BOVINE LEPTOSPIRAL MENINGITIS AND UVEITIS.

Warren G. Hoag and Wilson B. Bell; *Virginia Agricultural Experiment Station, Blacksburg.*

Herein reported are two cases in cattle involving unusual syndroma due to *Leptospira pomona* infection. Meningitic symptoms reported in a two-year-old steer are conjunctivitis, profuse salivation, stiffness of foreparts, tenseness of facial muscles and ears, and high temperature. Tentative clinical diagnosis of leptospirosis was confirmed serologically. Recovery was spontaneous and uneventful. Subsequent post mortem examination revealed some evidence of chronic interstitial nephritis and conjunctival petechical hemorrhages. No recovery of the organism was made. Unilateral uveitis is an experimental six-week-old calf occurred seven days after intramuscular inoculation of a prepaartion containing living *Leptospira pomona* and three days after the first spiking of fever occurred.

Intraocular puncture and immediate culture of the anterior chamber fluid resulted in recovery of organisms which proved to be identical to

the leptospiral serotype inoculated intramuscularly. *Leptospira pomona* was also isolated from the bloodstream on the sixth day after exposure as part of a calf passage experiment. Recovery was spontaneous and uneventful.

MINUTES OF THE SECTION OF PSYCHOLOGY [10]

STANLEY B. WILLIAMS, *Chairman*
HANNAH S. DAVIS, *Secretary-Treasurer*
REUBEN S. HORLICK, *Executive Committeeman*
RICHARD H. HENNEMAN, *Section Editor*

FRIDAY, MAY 7, 1954—9:00 A.M.—PEABODY HALL

CLINICAL SECTION, ROOM 1, PEABODY HALL

1. AN ALTERNATE FORM OF THE SHIPLEY-HARTFORD ABSTRACTION SCALE.

Reuben S. Horlick; *Walter Reed Army Hospital, Washington, D.C.*

This study concerns itself with the development of an alternate form to the Shipley-Hartford Scale, which has been found useful in obtaining a quick estimate of present intellectual functioning and for detecting impairment in mental efficiency.

The original and alternate forms of the Shipley-Hartford Scale were administered to two groups of army male recruits. Group A (112 men) was given the alternate form first and the original immediately afterward. To Group B, the tests were administered in reverse order.

The coefficient of correlation between Form 1 and Form 2 for Group A is .79 and for Group B, .80. The main differences from test to test are significant at the .01 level for Group A, and at the point .02 level of confidence for Group B. Approximately the same degree of variability is present in the two forms and the order of presentation does not alter significantly the test scores.

An alternate form to the Shipley-Hartford Abstraction Scale has been developed, and preliminary evaluation with two groups of army recruits indicates a high degree of reliability. It is, therefore, believed that the alternate form may be safely substituted for the original, when necessary.

2. ABSTRACT AND CONCRETE THINKING IN SCHIZOPHRENIA: A VOCABULARY STUDY.

A. W. Jeffreys, Jr.; *Richmond Professional Institute.*

The present study is one of a series of proposed investigations into the language and thought of schizophrenics. It limits itself to a specific testable hypothesis of Goldstein, who states that in the language of the schizophrenic "there is an absence of generic words which signify categories or classes. Or when they do use such words, analysis shows that . . . they do not conform to generalizations."

To test this hypothesis, the first 37 words of Wechsler's vocabulary subtest (Form II) were administered to 20 schizophrenics and 20 psychiatric attendants, the two groups being matched in age, intelligence, and education. Each definition was classified according to Green's method into one of five categories.

The tests were scored and tabulations made to arrive at the total number of responses each of the two groups had in each of the five categories. Primary interest was in the performance of the two groups in the number of responses in category 1 (for which they had to assume the more abstract attitude, producing definitions signifying categories or classes). It was found that the schizophrenic group produced more category 1 responses than did the comparison group. This difference was significant in the .05 level of confidence, and Goldstein's hypothesis was rejected.

3. AN INVESTIGATION OF REVISED BETA SCORES (LINDNER-GURVITZ SCALE) AMONG NEGRO ADOLESCENTS.

Walter A. Woods, Jack H. Boger, and Georgiana L. Holman; *Richmond Professional Institute and Richmond Public Schools.*

Testing experience had revealed that Negro adolescents, delinquent and not delinquent, typically scored lower on subtest four of the Lindner-Gurvitz Scale of the Revised Beta, than on any other sub-test. Since the Lindner-Gurvitz Scale was designed to provide sub-test equality, it appeared desirable to determine whether a real difference existed among Negro adolescents in performance on the Beta sub-tests.

Test results of 39 female and 32 male Negro juvenile delinquents and 35 female and 15 male Negro adolescents were analyzed for differences between (1) sexes, (2) sub-test means, and (3) total test means. All differences were tested at the .05 level by F test and critical differences. Sub-test and total test scale score intercorrelations were determined.

It was found that (1) non-delinquents score significantly higher than delinquents, (2) sex differences are not significant, (3) subtest four mean score is significantly lower than any other sub-test score, (4) sub-test four correlates .66 with total score, and when compared to other sub-test-total score correlations, is highly related.

It is concluded that either the Lindner-Gurvitz Scaled scores do not contribute equally to total score or that some cultural factor causes adolescent Negroes to perform particularly badly on sub-test Four.

4. HOUSE-TREE-PERSON RESEARCH ON CHILDREN.

A. THEORY AND METHOD IN H-T-P RESEARCH.

Vytautas J. Bieliauskas; *Richmond Professional Institute.*

In addition to psychological techniques devised to test different personality characteristics through evaluation of verbal expression, drawing has attracted the attention of the clinicians for some time. For about 15 years, drawing has been used in the United States as a projective techni-

que. Buck's H-T-P manuscript was one of the first publications of this kind, representing a psychological test for the appraisal of adults.

In the fall of 1952, RPI's Graduate School of Clinical and Applied Psychology initiated a long range H-T-P research project which has been discussed and encouraged both by Buck and by the members of the H-T-P panel at the 1953 APA meetings in Cleveland, Ohio. This project includes three main steps: (1) a developmental study of children's drawings and adaptation of the scoring system to children, (2) qualitative studies of children's H-T-P, and the integration of these qualitative findings with current personality theories, and (3) cross-validation of the adult's H-T-P following the findings on children.

The three studies presented on this panel hereafter were done on random samples drawn from 10,576 children's drawings of H-T-P, obtained from Illinois public schools, and they represent the developmental data on the drawing of the House, the Tree, and the Person. The fourth paper endeavors in theoretical considerations concerning perception and representational drawing, and a comparison of representational drawing with children's drawings.

B. DEVELOPMENTAL ASPECTS IN DRAWING OF THE HOUSE.

Walter A. Woods and Lawrence C. Repucci; *Richmond Professional Institute.*

A study of 374 H-T-P house drawings, sub-divided by school grade —— 1st through 9th grade,——was conducted to ascertain developmental trends. Drawings were studied and classified according to the following criteria:

I. Dimensions, sub-divided into one and two point perspective, implied perspective, double perspective, flat frontal view, interposed planes, parallel planes, and relative size;

II. Picture structure, which included proportion, composition, basic geometrical structure and page placement; and

III. Details —— essential and non-essential. These classifications differ somewhat from those of Buck.

It was found that (1) three dimensional representation is clearly developmental, as is the style of composition and the structuring of the picture. The use of details has less clear developmental significance. The use of some details decreases while the use of other details increases with increase in age.

Cultural determinants of developmental differences have not been investigated.

C. THE DEVELOPMENT OF FORM CONCEPTS IN THE DRAWING OF A TREE BY CHILDREN: KINDERGARTEN THROUGH THE NINTH GRADE.

Frank X. Duffy (read by John J. Digiammo); *Richmond Professional Instittue and Mt. Pleasant Mental Health Institute.*

A sample of 500 H-T-P tree drawings were examined. The various aspects and form qualities of the drawings were tallied under six main

headings as follows: (a) Development of the use of ground line and paper basing, (b) Development of the use of space, (c) Development of the tree form, (d) Development of two or more dimensions, (e) Development of light and shade and the modeling of a surface, and (f) Development of the use of details. It was found that males and females did not differ significantly in their representations of a tree by drawing. There was a general tendency at all grade levels to have a preference for curved rather than straight lines.

The progression appears to be from the simple geometric forms——circles and squares——found in the Kindergarten to the more detailed complex representations——interposition, light and shade and modeling——of the ninth grade. The present study permits the conclusion that there are several stages in the development of drawing so that ability to draw improves with experience and training.

D. DEVELOPMENTAL TRENDS IN CHILDREN'S H-T-P DRAWINGS OF A PERSON.

Vytautas J. Bieliauskas and Leonard W. Pennington, Jr.; *Richmond Professional Institute.*

A study of 630 H-T-P person drawings, representing chronological ages 4½ to 15, was made to determine developmental trends.

The following aspects of the drawings were studied: (1) *Composition,* (2) *Proportions,* (3) *Dimensions,* and (4) *Details.* Composition includes the placement of the figure on the page, position of the limbs, detail forms, etc. Grouped under proportions are the size of the figure and several interpart ratios. Dimensions involve one dimensional and two dimensional representations, as well as three dimensions, or depth representation. Details refer to the presence or absence of a part of the figure or its clothing.

The sample was divided into one-half year groups and the drawings were evaluated in terms of 97 categories. Significant age differences were found in many respects of Composition, Proportion, and Dimensions, as well as Details. Statistical findings warranted the hypothesis that many aspects of person drawings clearly show changes occurring with age and that therefore, they may be termed as developmental changes. The nature of the development of person drawing is, in general, in the direction of greater complexity and conformity to the visual appearance of human figure.

Sex differences were found in several aspects of the person drawings; they were particularly noticeable in mode of presentation.

No qualitative conclusions were drawn on the basis of this study.

5. THE INFLUENCE OF EMOTIONAL DEPRIVATIONS ON THE TEST SCORES OF INFANTS.

Catherine T. Giblette; *Memorial Guidance Clinic, Richmond.*

The study presents twenty-eight infants who were psychologically examined before and after placement or treatment. Many of them rated

low and even mentally defective during their period of emotional neglect. Then after placement with foster parents which supplied the babies with love, companionship, and understanding, most of the infants' mental classifications showed remarkable gain. The several infants whose mental quotients failed to rise were in homes that were destructive to their development, or they continued to live in an institution.

It is concluded that:

1. Infants are unable to develop when they are deprived of emotional satisfactions.
2. The Clinical Psychologist should be most careful and cautious in interpreting an infant's test results. He should acqauint himself thoroughly with the emotional background of the baby.
3. In placing infants the foster parents should be selected most carefully as to their feeling for the babies and capacity to guide their mental and emotional devolopment.

6. A PRELIMINARY REPORT OF SOME RORSCHACH CHARACTERISTICS OF ALCOHOLIC PATIENTS.

John Mendenhall; *Lynchburg State Colony.*

The standard Rorschach blots were administered to 138 male (voluntary alcoholic) patients. Significant findings were high animal percentage, presence of black color response, and a W to M ratio of 3 to 1 or more. Qualitatively, the records suggested sudden emotional outbursts and a neurotic personality structure. Low insight and active conflict were present, with a generalized sexual insecurity. Projection was a common defense mechanism.

This group was compared with a group of 124 alcoholic patients to whom the Behn blots had been administered. No significant difference was found in the two sets of protocols except that CF responses tended to predominate on the Rorschach while FC responses tended to predominate on the Behn.

A group of 24 dull-average intellectual patients and a second group of 30 patients of high-average intelligence were separated from the Rorschach group. The general profile obtained earlier on the Rorschach tended to hold true in each group, with the exception that the number of shading responses tended to drop in the dull-average records. No correlation was seen between intelligence and the W to M ratio or animal percentage.

7. IDENTIFICATION AND GUIDANCE OF GIFTED CHILDREN IN THE ELEMENTARY SCHOOLS.

Antonia Bell Morgan; *Aptitude Associates Incorporated, Merrifield.*

The history of the problem is briefly reviewed, with particular reference to ancient Greece, 19th century England, and modern psychological and educational trends.

A study of the figures of the winners in the Westinghouse Annual Science Talent Search reveals an uneven distribution suggesting that meas-

ures to identify and foster talent in the schools are likewise unevenly distributed.

For most effective guidance, gifted children should be identified in the elementary schools. Provisions for gifted children in the elementary schools take the form of (a) homogeneous grouping, (b) enrichment, or (c) acceleration. The assets and drawbacks of each of these methods are discussed with special reference to the programs of Hunter College and of the State of Oregon.

The following conclusions are reached:

(a) In many school systems the needs of gifted children are not being adequately met.
(b) There should be special provisions for such children in the elementary schools.
(c) In the elementary schools either homogeneous grouping or acceleration is usually preferable to enrichment.
(d) Each gifted child should be given a comprehensive psychological examination and periodic guidance on the basis of the findings.
(e) A program for the identification and guidance of gifted children in the elementary schools must be flexible, simple, and relatively inexpensive.

A tentative program is proposed which would meet the requirements outlined in (e) above.

EXPERIMENTAL SECTION, ROOM 15, PEABODY HALL

1. VISUAL DIFFERENTIATION AFTER NON-REINFORCED TRAINING IN DIFFERENTIATED ALLEYWAYS OF A T-MAZE.

Melvin Freitag; *University of Virginia.*

Rats were given unrewarded trials in brightness-differentiated alleys and goal-boxes of a T-maze. They were then placed in a different brightness discrimination situation where one of the cue complexes (brightness) was associated with food. After the discrimination had been established the animals were placed in a gray T-maze having colored goal-boxes. The rats had not benefited from their previous unrewarded position training as demonstrated by the fact that they did not respond appropriately. They did not learn the location of food any faster than the control group that received their training in a gray maze with colored goal-boxes.

2. AN EXPERIMENTAL EVALUATION OF THE GENERAL DRIVE CONCEPT

James G. Holland; *University of Virginia.*

An experiment in progress was reported which was designed to test the general drive hypothesis without using drives that are intrinsically confounded as are hunger and thirst. Rats were trained in a Skinner box to avoid shock by pressing a lever. When the avoidance habit was well established the animals were deprived for either 0, 24, 48, or 72 hours.

They were then returned to the Skinner box and tested for the different rates of responding that should result from the different drive levels. Of the eleven animals which have completed the experiment thus far, all but one responded at a lower rate during the test session than during the last acquisition session. These incomplete data would suggest thaet there will probably be no significant group differences. If this is verified in further planned research, the general drive hypothesis will have to be either abandoned or modified.

3. CONFLICT-PRODUCED CHANGES IN THE BEHAVIOR PATTERNS OF RATS.

William A. Lee; *University of Virginia.*

Six water-deprived rats were taught to perform a brightness discrimination in a snug restraining cage. Correct responses were rewarded with water, and incorrect responses were punished with electric shock. When the discrimination was well established, three of the animals were presented with a conflict situation by reducing the difference in brightness which was to be discriminated. The conflict was continued during six daily training sessions while the three control animals continued to perform the original discrimination. No differences were found between the two groups during the six day period with respect to changes in activity in the home cages, food consumption, or body weight. The control groups demonstrated better retention of a previously learned bar-pressing habit. The control group also recovered more rapidly from an "emotional state" produced by a bright flash of light.

4. CUTANEOUS COMMUNICATION SYSTEMS UTILIZING MECHANICAL VIBRATION.

Paul Spector; *University of Virginia.*

Past failures to transmit speech directly to the skin by means of vibration make it appear that information must be encoded to be transmitted tactually.

Intensity, temporality, and spatial extent of vibratory stimulus were explored in an attempt to determine the number of cues in each that can be utilized in encoding information.

Six experiments were conducted. Two studies investigating the difference limens for intensity and duration preceded two further studies in which equal levels of intensity and of duration which could be identified with an accuracy of 100 percent were found. All subjects could identify three levels of j.n.d.'s in each dimension consistently.

In a fifth study it was found that all subjects could identify four loci of vibration correctly although none could identify more than six levels.

In a final experiment a determination was made of the ability of subjects to identify several aspects of the vibratory stimulus.

Thirty-six stimuli were delivered and of the four subjects who participated, one made no errors, and each of the others made one error.

5. VISUAL CONTRIBUTION TO SPEECH INTELLIGIBILITY IN NOISE.

William H. Sumby; *University of Virginia.*

Oral speech intelligibility tests were conducted with and without supplementary visual observation of the speaker's facial and lip movements. The difference between these two conditions was examined as a function of the speech-to-noise ratio and the size of the vocabulary under test. The visual contribution to oral speech intelligibility (relative to its possible contribution) is, to a first approximation, independent of the speech-to-noise ratio under test. However, since there is a much greater opportunity for the visual contribution at low speech-to-noise ratios, its absolute contribution can be exploited more profitably under these conditions.

6. DURATION OF SUCCESS-BACKGROUND AND THE EFFECT OF FAILURE UPON PERFORMANCE.

James A. Bayton; *Howard University.*

The present experiment was designed to yield data on two critical problems: 1) is introduction into a failure situation after a series of successes accompanied by erratic performance? and 2) is the level of performance under failure a function of the extent of prior success experiences?

Seventy-five male subjects were used in the experiment. They were randomly divided into three groups. They received varying amounts of prior success before being introduced to failure. The task used was the Minnesota Rate of Manipulation Test.

The results gave evidence that erratic performance resulting from a success-failure situation is perhaps a function of the sex of the experimenter. The results also demonstrated that the level of performance under failure is a function of the extent of prior success. With a limited amount of success prior to failure there is no differential influence on performance. However, with a relatively large amount of prior success there is a differential increase in speed under a failure situation. Accumulation of success background facilitated learning under subsequent failures.

7. THE EFFECT OF VARIABLE AMOUNT OF REINFORCEMENT UPON THE RATE OF RESPONSE.

Kenneth Hageman; *College of William and Mary.*

8. THE EFFECT OF KNOWLEDGE OF RESULTS ON THE ACCURACY OF A PURE GUESSING RESPONSE.

Burton R. Wolin and Althea M. Iliff; *College of William and Mary.*

9. THE EFFECT OF DIFFERING NUTRITIVE REINFORCEMENT UPON LEARNING.

William Wagman; *College of William and Mary.*

The purpose of this experiment was to determine if rats will learn to run to diluted food as well as to regular food. Such an experiment might

help in clarifying the term "reinforcement".

Three groups of animals were tested for reaction latency and running time in a closed runway. Food pellets for the three groups consisted of 100%, 50%, and 20% Purina Chow respectively. Dilution was with non-nutritive fiber and sawdust. All pellets were of the same size. An addition of 1% saccharine was used to mask potentially different tastes. All animals were run once a day every other day during learning and three times a day every other day during extinction.

The results show no differences between groups during acquisition and extinction. It is hypothesized that nutritive value has no reinforcing effects when bulk and taste are held constant.

10. DIFFUSION THEORY AND ITS APPLICATIONS TO SOCIAL RESEARCH.
Henry Winthrop; *Richmond Professional Institute.*

The objectives of diffusion theory, both theoretical and applied, are stated. Various types of diffusion theory are mentioned. The difference between clock-time and remove-time models is discussed. The nature of a two-stage theory of diffusion is described. The basic parameters of diffusion theory are explained. The basic taxonomy of the necessary mathematical models is furnished. A representative diffusion model is given and recent empirical application of diffusion theory touched upon.

BUSINESS MEETING, ROOM 106, PEABODY HALL

The business meeting was opened by the Chairman at 2:00 p.m. A slate of two candidates for each of the three offices was presented by the Chairman of the Nominating Committee. The following officers were elected by ballot: Chairman, Gilbert J. Rich; Secretary-Treasurer, Audrey M. Shuey; Executive Committeeman, Henry A. Imus.

The Section editor announced that the editorial staff of the Journal would like a report of the Section's feeling about whether titles and/or abstracts of articles by the V.A.S. members published during the year should appear in one Journal issue during the year. Sixteen members felt the listing advisable, 10 were against it, and 12 had no feeling about the matter.

The Secretary's and Treasurer's reports were accepted as read.

The Chairman asked the Section if it wished to go on record with a letter to the Governor expressing its opinion on the reappointment of the Commissioner of Mental Hygiene and Hospitals. A motion was made and seconded that the Section write a letter to the Governor (with a copy to Dr. Barrett) requesting the reappointment of the present Commissioner of Mental Hygiene and Hospitals. After discussion, it seemed clear that the majority of the members present were of the opinion that this was not an appropriate question for the Section to take action on, and the motion, therefore, failed.

Just prior to this meeting, the Chairman had received a letter from a member in Richmond expressing the views of several of the members of

the Richmond Psychological Association. The letter indicated that the present Section did not meet all the needs of all the psychologists in Virginia and suggested that the matter be brought up at the business meeting with a view toward either changing the present organization to meet these needs or forming a new psychological association. The Chairman reported that this matter had already been discussed by the Section's Executive Committee and subsequently by the Executive Committee and the delegate of the Richmond group. The Chairman also reported that it had been suggested that the new officers appoint a study committee and meet with them to discuss the whole matter of reorganization and/or separation from the Section. A member then made the following motion: I move that the incoming Executive Committee be instructed to appoint a committee of three to five members, which committee would be representative of the members of this Section, to re-examine and re-evaluate the constitution, functions, and responsibilities of the Psychology Section and to report to the Board its findings and recommendations at the earliest opportunity. This motion was carried.

The meeting adjourned at three o'clock.

SYMPOSIUM, 3:00 P.M.—PEABODY HALL

What Kind of Research Studies do Clinical Psychologists Need?

Chairman William N. Hinton, Washington and Lee University;
Dr. Harold M. Hildreth, Veterans' Administration Central Office;
Dr. Thelma Hunt, George Washington University;
Dr. Morris Roseman, Veterans' Administration Regional Hospital;
Dr. Burton R. Wolin, College of William and Mary.

MINUTES OF
THE SECTION OF SCIENCE TEACHERS [11]

CAROLINE GAMBRILL, *Chairman*
G. L. THOMASSON, *Chairman-Elect*
MARTHA W. DUKE, *Secretary*
L. W. JARMAN, *Section Editor* (1954)

FRIDAY, MAY 7, 1954—9:30—ROOM 122, COBB CHEMICAL LAB.

1. THE SCIENCE TEACHER'S RESPONSIBILITY IN CIVIL DEFENSE.
Thomas E. Gilmer; *Hampden-Sydney.*

2. ATOMIC ENERGY.
Edward C. Stevenson; *University of Virginia.*

The Gamow-Alpher theory of the origin and explanation of our expanding universe was cited as a gigantic thermonuclear reaction which, interrupted before it had gone to completion, provides us with the rarity and abundance of the elements as we find them today, approximately five billion years later. The binding energies of the isotopes were developed from a consideration of mass measurements, and Einstein's mass-energy equation and the two possibilities of fission or fusion for extracting further energy by rearrangement of nucleons were discussed. The fusion process in thermonuclear reactions at high temperatures provided by a fission A-bomb was examined with regard to the most promising materials to use.

The impossibility of an H-bomb explosion "getting out-of-hand and setting off" the atmosphere or ocean was pointed out.

3. WHAT'S NEW IN CRYSTALS.
Nicolas Cabrera; *University of Virginia.*

Atoms interact with each other by forces which have only recently been understood. Those short-range forces, usually called chemical forces, are of quantum-mechanical nature. Because of those forces atoms join together forming groups of finite dimensions which we call molecules or of infinite dimensions which we call crystals. The entire field of Biology is based on the existence of large molecules about which we know very little. On the contrary, our knowledge of the properties of crystals, developed during the last half-century, is very complete. The understanding of it is based on the hypothesis that the atoms form a perfectly periodical lattice, extending through the entire volume occupied by the crystal. It is only recently, however, that there has been recognized the necessity of introducing the possibility of geometrical imperfections in the lattice in order to explain some of the most important properties of solids, such as

mechanical properties, crystal growth, etc. These geometrical imperfections (dislocations) have been observed recently.

4. WHAT'S NEW IN NUCLEAR PHYSICS.

Frank L. Hereford; *University of Virginia.*

The current status of nuclear physics and the physics of elementary particles was reviewed. These fields of physics are experiencing very great difficulties at the present time due primarily to the experimental discovery of an abundance of different elementary particles. There is a place within the framework of physics for many of these new particles. For example, the bi-meson is thought to be the quantum of the nuclear force field analogous to the photon as the quantum of the electromagnetic field. However, most of the recently discovered particles (K-particles and hyperons) have not as yet found a home within physical theory. The role of the giant accelerators (e.g., the recently completed bevatron) in adding to our knowledge of the properties of these new particles was also indicated.

BUSINESS MEETING

Miss Gambrill appointed Mr. L. W. Jarman, Mr. A. B. Niemeyer and Mr. Harry M. White to serve on the nominating committee. The following slate was presented:

Chairman-Elect——Franklin D. Kizer
Secretary——Martha W. Duke
Section-Editor——Caroline Gambrill

As there were no nominations from the floor, these officers were declared elected.

MINUTES OF
THE SECTION OF STATISTICS [12]

W. S. Connor, *Chairman*
M. C. K. TWEEDIE, *Vice-Chairman*
C. Y. KRAMER, *Secretary*
LIONEL WEISS, *Editor* (1957)

FRIDAY, MAY 7, 1954—9:00 A.M.—ROOM 243, CABELL HALL

1. THREE-DECISION TESTS OF A DIFFERENCE BETWEEN TWO MEANS.[1]
D. B. Duncan; *Virginia Polytechnic Institute.*

A distinction is first made between a *two-decision* test of H_0: $\delta = 0$ in which the decisions are D_0: accept H_0 and D_1: accept H_a: $\delta \neq 0$ and a *three-decision* test of H_0: $\delta = 0$ in which the decisions are D_-: accept H_-: $\delta < 0$, D_0: do not reject H_0, and D_+: accept H_+: $\delta > 0$; where δ is the expected difference between two sample means. It is shown that the operating characteristic curve of a two-decision test cannot be used satisfactorily to represent the properties of a three-decision test, as is sometimes attempted. An α–level three-decision test may be usefully regarded as a combination of two two-decision tests; one, an α_1–level test of $\delta \leq 0$ against $\delta > 0$, the other, an α_2 –level test of $\delta \geq 0$ against $\delta < 0$; where $\alpha = \alpha_1 + \alpha_2$. The operating characteristics of the three-decision test are given by the operating characteristics curves of these two tests. Attention is also drawn to another type of two-decision test having decisions D_- and D_+. This may be regarded as a special case of the three-decision test in which D_0 is excluded by putting $\alpha = 100\%$.

2. ON A NEW METHOD OF ANALYZING EXTREME-VALUE DATA.[2]
Julius Lieblein; *National Bureau of Standards.*

This paper presents an approach to estimation of the parameters of the extreme-value distribution

$F(x) = \text{Prob}\ (X \leq x) = \exp\ (e^{-(x-u)/\beta})$ by means of linear functions of order statistics, $T = \sum_{i=1}^{n} w_i x_i$, where $x_1 \leq x_2 \leq \ldots \leq x_n$ are the order statistics in a random sample of size n from $F(x)$. Two desirable properties of such estimators are unbiasedness and minimum variance (from among such estimators). These two properties uniquely determine

[1] Sponsored by Office of Ordnance Research, U. S. Army.
[2] Sponsored by the National Advisory Committee for Aeronautics.

the n weights w_i from the means, variances and covariances of the x_i. The means have previously been tabulated. Explicit formulas which have been found permit simple numerical computation of the variances and covariances from tabulated functions alone. Estimators based on these are constructed for samples of $n \leq 6$, larger samples being handled by breaking up into subgroups of six or less. This method appears to offer the following advantages over existing methods based on mean and standard deviation of an entire sample: (1) the estimators are unbiased; (2) in many cases the estimators have greater efficiency; (3) breaking sample into subgroups allows possibility of checking whether data are random and come from assumed type of distribution.

3. SOME DUPLEX METHODS OF USING DESK CALCULATORS IN STATISTICS.

M. C. K. Tweedie; *Virginia Polytechnic Institute.*

Some methods of doing two separate calculations simultaneously on a desk-type digital calculator are very efficient in some problems, but are not known very widely. The method of finding $S(x)$ and $S(x^2)$, or $S(fx)$ and $S(fx^2)$ for grouped data, by entering 1 and x, or x and x^2, on opposite ends of the multiplier keyboard, is perhaps fairly well known. This paper demonstrates how, following this stage, the sum of squares can be corrected to $S(x - \bar{x})^2$ simultaneously with the calculation of the mean $(\bar{x})$, by setting up n under $S(x)$ and $S(x)$ under $S(x^2)$, and carrying out the operation of dividing n into $S(x)$. The corrected sum of squares is produced in a position where it can be divided by n or by n-1 to give the variance. Details, including limitations, of several variants of this idea are given. The ease of usage of at least one of these variants (depending on the type of machine) can greatly facilitate the calculation of variances from small samples, such as arise in some quality control techniques and analyses of variance. The same broad idea can also be used to get the corrected sum of products $S(x - \bar{x})(y - \bar{y})$ from the raw sums $S(xy)$, $S(x)$, $S(y)$, simultaneously with the computation of $\bar{x}$ (or $\bar{y}$).

4. ON A PROBLEM IN FITTING A STRAIGHT LINE.

W. S. Connor; *National Bureau of Standards.*

Phenomena sometimes occur for which it is known that certain observable variables x and y have a functional relationship of the form

$$y = \alpha + \beta x,$$

but the constants α and β are unknown.

Suppose that it is desired to estimate α and β by estimating two points on the line, (x_1, y_1) and (x_2, y_2), $(x_1 < x_2)$. Further suppose that x_i $(i = 1, 2)$ is known without error but that y_i can be observed only through the random variable Y_i which has a continuous distribution function with a unique median, y_i.

Let the observations $y_{i1}, \ldots, y_{iN1}$ on Y_i be independent. Then a simple non-parametric simultaneous confidence interval for all the y's may

be constructed in the following way. Arrange $y_{i1}, \ldots, y_{iN_i}$ in increasing order and select the k_i th and $(N_i - k_i + 1)$ th order statistics ($k_i \leq (N_i - 1)/2$), which may be denoted by $y_i(_{ki})$ and $y_i(_{N_i - k_i + 1})$, respectively. Consider the points $Z_{1L} = (x_1, y_1(_{k1}))$, $Z_{1U} = (x_1, y_1(_{N1 - k1 + 1}))$, $Z_{2L} = (x_2, y_2(_{k2}))$, and $Z_{2U} = (x_2, y_2(_{N2 - k2 + 1}))$. Then the upper simultaneous confidence limit consists of the following three straight line segments: (1) the line determined by Z_{1U} an Z_{2L} for $-\infty < x \leq x_1$, (2) the line determined by Z_{1U} and Z_{2U} for $x_1 < x \leq x_2$, and (3) the line determined by Z_{1L} and Z_{2U} for $x_2 < x < \infty$. The lower limit is determined analogously.

Let

$$P_i = \left(\tfrac{1}{2}\right)^{N_i} \sum_{j=k_i}^{N_i - k_i + 1} \binom{N_i}{j}, \qquad (i = 1, 2).$$

Then the confidence coefficient associated with the interval is P_1P_2.

5. SOME TOPICS IN VARIANCE COMPONENT ANALYSIS.

W. A. Thompson, Jr.; *Virginia Polytechnic Institute.*

Wald's confidence interval ("A Note on Regression Analysis", Annals of Math. Stat., p. 586, Dec. 1947) is specialized to the case of incomplete block designs with random block effects. A theorem concerning the multiplicity of the characteristic roots of the variance-covariance matrix of the adjusted yields is discussed and applied to Wald's confidence interval. A practical example is discussed.

This work was done under contracts with the Air Force and the Quartermaster Corps.

6. A STATISTICAL ANALYSIS OF THE INSONATION EFFECTS OF *Escherichia coli.*

Patricia Ripley, M. C. K. Tweedie and Dudley Thompson; *Virginia Polytechnic Institute.*

The lethal effects ultrasonics have an *E. coli* under various times and intensities of insonation were studied in this experiment, using statistical methods.

Five hour cultures were treated by insonation at 400 kilocycles for either 1, 3, 9, or 27 minutes. The intensity levels were 15 milliamperes at 100 volts, 30 milliamperes at 200 volts, 70 milliamperes at 400 volts, 130 amperes at 800 volts, and 270 milliamperes at 1600 volts. Two controls were prepared for each treated sample. After insonation all three samples were cultured in petri dishes and their colonies counted in 24 hours.

A 100 per cent killing effect was observed at 270 milliamperes and 1600 volts, and nine minutes. Large variation between and within controls prevented direct interpretation of results. The scatter between controls was considerably greater than for a Poisson distribution. Methods for analyzing the data to measure the incomplete killing effect at lighter intensities and shorter time exposures are currently in progress. Exponential laws of decrease in colony count against duration of insonation fit approximately.

7. A MINIMIZATION PROBLEM.

Joseph B. Jordan; *Headquarters, USAF.*

A square matrix can be rearranged by permuting the rows and columns in an identical manner. It is desired to find the rearrangement of this type which will give the minimum sum of the elements above the main diagonal.

The method described is one which has been used on the Univac at the Office of the Comptroller, Hq. USAF. The original matrix is expressed as the sum of a symmetric and a skew-symmetric matrix. Since the symmetric matrix has an invariant sum above the main diagonal under the kind of rearrangements allowed, it can be ignored. A series of permutations of rows and corresponding columns is found which will minimize the sum for the skew-symmetric matrix. The series of permutations is reduced to one equivalent permutation, which is applied to the original matrix to minimize its sum above the main diagonal. The advantage gained by working with the skew-symmetric matrix is that since $a_{ij} = -a_{ji}$, it is necessary to store only the elements above the main diagonal. This more than doubles the size of the matrix which can be readily handled.

The solution found is not necessarily the true minimum. Known methods which would assure finding the true minimum require a prohibitive amount of computation. Empirical tests have shown that the method described generally produces a substantial reduction in the sum above the main diagonal.

8. THE OPTIMUM TRANSPORTATION PROBLEM.

Melchior J. DiCarlo-Cottone; *Headquarters, USAF.*

Let X_{ij} be the amount of a homogeneous product which is to be shipped from origin $i (i = 1, 2, \ldots, m)$ to destination $j (j = 1, 2, \ldots, n)$. Let the amount to be shipped from each origin be a_i and the amount to be received by each destination be b_j. Further, let it be stipulated that the total supply equals the total demand. A table c_{ij} is given, which is the cost of shipping a unit amount from the i^{th} origin to the j^{th} destination. The problem is to minimize the total cost.

Stated algebraically, let

$$(1) \quad \sum_{j=1}^{n} X_{ij} = a_i \qquad i = 1, 2, \ldots, m$$

$$(2) \quad \sum_{i=1}^{m} X_{ij} = b_i \qquad j = 1, 2, \ldots, n$$

$$(3) \quad \sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_j$$

$$(4) \quad X_{ij} \geq 0$$

then choosing the correct X_{ij} in (1), (2) and (4) we have

$$(5) \quad \sum_{j=1}^{n} \sum_{i=1}^{m} c_{ij} X_{ij} = \text{Minimum}$$

An illustrative example using a 3×5 c_{ij} matrix, a 3 element column vector and a 5 element row vector is presented.

A simplified flow diagram, utilizing the above principles, shows the approach used in adapting such a problem to a large-scale digital computer.

9. AUTOMATIC PROGRAMMING.

Natalie Coplan; *Headquarters, USAF.*

A large scale digital computer solves problems as directed by sets of instructions called programs. Ordinarily, these instructions are the result of much human effort. Manual preparation is a long, arduous job. Techniques are being developed which enable the computer to assume much of this labor. These techniques and their role in problem solution are explored.

As an example of the compiler techniques, the steps involved in the tabulation of the function

$$x = \frac{b(a - c \cos \alpha)}{\sqrt{z^2 + a^2 + c^2 - 2ac \cos \alpha}}$$

are discussed.

10. THE EFFECTS OF BIMODALITY AND OF SKEWNESS IN A POPULATION ON THE DISTRIBUTION OF "T".

J. C. Layman and R. A. Bradley; *Virginia Polytechnic Institute.*

The small sample test, known as the "t" test, for hypotheses on the mean of a normal population developed by "Student" and modified and extended by R. A. Fisher is still of outstanding importance in Statistics. For the strict validity of the test it is required that the sample be of independent observations from a single Gaussian distribution. In practice these conditons are never more than approximately met.

R. A. Bradley, in 1952, presented a general mathematical approach to

obtaining approximations to the distribution of "t" for specified non-normal populations. Examples developed were restricted to symmetrically distributed populations.

In the present paper, the effects of sampling from a mixed population with density function $f(x) = a_1 \phi_1 + a_2 \phi_2$, where $a_1 + a_2 = 1$; a_1, $a_2 \geq 0$ and ϕ_1, ϕ_2 are normal or Gaussian densities with possibly different means and variances were partially investigated. This density is of interest since, with changes in a_1, a_2 and the means or variances of the ϕ's, it may be used to represent populations which are bimodal or which have varying degrees of skewness.

Two special forms of the general density above were selected and studied in some detail for samples of size two. The results obtained from the study of the two density functions considered indicate that the probabilities that "t" exceed preassigned values t_0 differ only slightly from the corresponding probabilities for the normal density. Thus, these results substantiate the opinion that the effects of moderate departures from normality may not be serious in the analysis of variance of sample means.

11. ANALYSIS F PASTURE DATA IN 3 x 3 LATIN SQUARES. WITH ROWS AND SINGLE OBSERVATIONS MISSING.

N. R. Thompson and C. Y. Kramer; *Virginia Polytechnic Institute.*

Three pasture mixtures were grown in four replicates, and grazed rotationally by three groups of dairy cows. The grazing plan followed was based on 3 x 3 Latin squares. Data on milk yields and body weights were taken. Yields of total digestible nutrients and dry matter per acre were estimated.

The rows of each Latin square represented successive grazings of a given replicate. In two seasons (1950, 1951) one square and one or two rows were completed. In one season (1952) two squares were completd, but a few observations were missing.

Analysis of the data with rows missing was done conveniently by the fitting of constants. Only two equations in two unknowns were needed to obtain each constant for "Mixtures" and "Groups". The analysis of variance then proceeded in the usual manner. Procedures using formulas for missing values were applied to the 1952 data.

With rows missing, "Mixture" means were adjusted for "Group" effects in the pooled analysis of all replicates and to test individual differences. With individual observations missing, actual means were used with appropriate standard errors.

12. SOME ASPECTS OF STATISTICS IN CANADA.

G. L. Edgett; *Virginia Polytechnic Institue and Queen's University.*

The scope of statistics in Canadian universities at the graduate and undergraduate level. The role played by statistics in industry and in government.

13. A 2 x 2 FACTORIAL WITH PAIRED COMPARISONS.

Robert M. Abelson and Ralph Allan Bradley; *Virginia Polytechnic Institute.*

The parameters previously specified for a method of paired comparisons are redefined in such a way as to permit the use of treatments in factorial array. The algebraic procedure is shown in general, but the normal equations resulting from the use of maximum likelihood are non-linear and difficult to solve. Easy solution of the normal equations seems to be limited to the 2 x 2 factorial and an explicit solution is given for that case.

The method of paired comparisons presented for 2 x 2 factorial treatments permits most of the comparisons available through usual analysis of variance. It is possible to test for the presence of both main effects and their interaction.

A numerical example is included.

14. TESTING ONE SIMPLE HYPOTHESIS AGAINST ANOTHER.

Lionel Weiss; *University of Virginia.*

For the problem of testing one simple hypothesis against another, of all tests whose probabilities of incorrectly accepting the first hypothesis and of incorrectly accepting the second hypothesis are bounded from above by given bounds, the familiar Wald sequential probability ratio test gives the smallest expectation of sample size under either hypothesis. In this paper, a "generalized sequential probability ratio test" is introduced which differs from the Wald test only in that the same limits (A, B in the usual notation) are not necessarily used at each stage of the sampling, but at the i^{th} stage A_i and B_i are used, where these numbers are predetermined constants. It is shown that for any given test T, there is a generalized sequential probability ratio test G whose probabilities of incorrectly accepting either hypothesis are no larger than the corresponding probabilities for T, and such that the cumulative distribution function of the number of observations required to come to a decision when using G is never below the corresponding distribution function when using T, under either hypothesis.

15. CURRENT RESEARCH IN CROP AND LIVESTOCK ESTIMATING.

H. F. Huddleston; *U. S. D. A.*

The present program of the Agricultural Estimates Division, USDA, has been providing a large volume of agricultural statistics quickly and cheaply for the users of State as well as National data. The techniques now in use for making crop and livestock estimates on the whole are less costly than the newer sampling methods developed over the past several decades. More recently, the techniques in use have received considerable criticism and have been highlighted by the report of the Special Subcommittee of the Committee on Agriculture of the House of Representatives which investigated the cotton forecast of 1951. In particular, statisticians have raised

questions about the methods and urged the adoption of modern survey methods even though the costs will be higher.

Because of the importance of cotton estimates, large-scale pilot surveys were conducted in North Carolina and Mississippi throughout the 1953 season on a cross-section sample of cotton growers drawn from PMA lists. In additon, cooperative research with the Statistical Laboratories at Iowa State College and North Carolina State College were continued and expanded. The work at North Carolina State College was tied in with the cotton studies. Studies at Iowa State College were directed toward investigating the magnitude of possible reporting errors in farmers' reports of corn acreage and production. Farmers' judgment estimates are being compared with objective measurements on a small sample of farms through the middle of the State.

16. SOME PROBLEMS OF OPTIMUM SAMPLING.

Paul N. Somerville; *Virginia Polytechnic Institute.*

This paper attempts to apply some of Wald's theory of decision functions, and in particular minimax methods to problems of optimum sample sizes.

Let $\pi_0, \pi_1, \ldots, \pi_k$ be $k+1$ populations identically distributed except for unknown parameters $\theta_0 \geq \theta_1 \geq \ldots \geq \theta_k$. It is desired to choose N individuals from π_0. A preliminary sample of n is taken from each population with the object of deciding which population is π_0. Let $W(\theta_i, \theta_0)$ be the loss involved in choosing the population with parameter θ_i, where $W(\theta_i, \theta_0) \geq 0$, $W(\theta_0, \theta_0) = 0$. Let $C(n)$ be the cost of taking the preliminary sample. It is shown that under certain conditions, the maximum expected loss over all values of θ_i, $i = 0, 1, 2, \ldots, k$ occurs where $\theta_1 = \theta_2 = \ldots = \theta_k$. This enables us to find the maximum expected loss, which can then be minimized with respect to the preliminary sample size.

If the sample means of the $k+1$ populations are normally distributed, and it is required to maximize the expectation of the N individuals (θ_i is the mean of π_i), then if the cost of the preliminary sample is a linear function of its size, it is shown that the n which minimizes the maximum expected loss is proportional to $N^{2/3}$. Explicit results are given for $k = 1, 2, 3, 4, 5$, for a one-state preliminary sample. For the case $k = 2$, results for a two-stage sample are given. In the first stage, samples of n_1 are taken from each of the three populations. In the second stage, samples of n_2 are taken from each of the two populations with the largest means in the first stage. If $3n_1 + 2n_2 = 3n$, then it is found that the maximum expected loss is less for the two-stage sample than for the one-stage sample provided n_1/n_2 is greater than .37 (approx.). The optimum ratio in this sense is found to be $n_1/n_2 = 1.2$ (approx.). If for this value of n_1/n_2 the maximum expected losses are equated by a reduction in the total sample size, a saving of 6.6 per cent over the one-stage procedure in the preliminary sample size is effected.

BUSINESS MEETING

The following were elected to serve as officers of the Section of Statistics for 1954-55:

Chairman—W. S. Connor
Vice-Chairman—M. C. K. Tweedie
Secretary—C. Y. Kramer
Editor—Lionel Weiss

A motion was proposed and carried to have the Statistics Section of the Virginia Academy of Science become a chapter of the American Statistical Association, to be known as the Virginia Academy of Science Chapter.

The Section voted in favor of having the *Virginia Journal of Science* carry a listing of papers and theses published by residents of the State of Virginia and members of the Virginia Academy of Science.

LIST OF MEMBERS

1953-1954

Note: Following are the types of membership in the Academy.

***Patrons*, who contribute one thousand dollars or more to the Academy.

**Life Members*, who contribute one hundred dollars or more to the Academy.

***Honorary Life Members* (Elected by Council).

**Sustaining Members*, who pay annual dues of ten dollars.

†*Contributing Members*, who pay annual dues of five dollars.

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Note: Number following name designates section, or sections, to which member belongs; "C" following name indicates "Student Member".

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3. Bacteriology
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5. Chemistry
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7. Engineering
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12. Statistics

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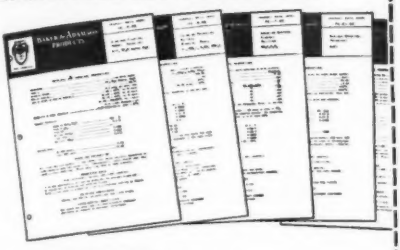

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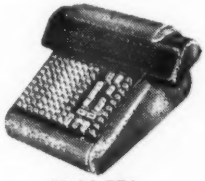

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